IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

FEDERAL TRADE COMMISSION, Plaintiff, v. BROWN & WILLIAMSON TOBACCO CORP., Defendant.	)	CIVIL ACTION NO. EXHIBITS ANNEXED TO DECLARATION OF WALLACE S. SNYDER IN SUPPORT OF PLAINTIFF'S MOTION FOR PRELIMINARY INJUNCTION

VOLUME IV

EXHIBITS 33 - 44 p. 40

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EXHIBIT 33

2021574795

FEDERAL TRADE COMMISSION
WASHINGTON, D.C. 20580

OFFICE OF THE SECRETARY

OCT 29 1981

Martin London
Paul, Weiss, Rifkind, Wharton & Garrison
345 Park Avenue
New York, New York 10154

Dear Mr. London:

The Commission wishes to apprise you of the status of the investigation concerning the request by the R.J. Reynolds Tobacco Company that the cigarette holder currently being used in the Commission's Cigarette Laboratory testing procedure be modified. On October 9, 1981 the Commission notified you by letter that it had asked the staff to prepare by October 19, 1981 a recommendation as to what action, if any, including what interim action, it believes is appropriate based upon the evidence available to it on that date. As directed, the staff forwarded its recommendations on October 19, 1981.

On October 15, 1981, the Brown and Williamson Tobacco Corporation submitted a letter to the Commission requesting that the Commission take no action on this investigation until Brown and Williamson submitted its response to the submissions of the other companies. At that time Brown and Williamson informed the Commission that it would file its response no later than October 23. Brown and Williamson's submission was received on October 23.

In light of the importance of this investigation, the Commission has decided to grant Brown and Williamson's request and will take no action on this matter until Brown and Williamson's submission has been reviewed. The Commission has instructed the staff to review this material promptly and to prepare a supplemental memorandum reporting the results of that review as soon as possible, but, in any case, no later than November 20. You may be assured that the Commission and the staff will continue to expedite this investigation in order to resolve it as rapidly as possible.

By direction of the Commission.

signed and hand-delivered

Carol M. Thomas
Secretary

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Identical letters (not attached) were sent to:

2. Joseph Greer, Liggett
3. Arthur J. Stevens, Lorillard
4. Arnold Henson, American Brands
5. Samuel B. Witt, III, RJR
6. Abe Krash, Counsel for PM
7. Alexander Holtzman, PM
8. Ernest Pepples, B&W

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EXHIBIT 34

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American Brands, Inc.
245 PARK AVENUE, NEW YORK, NEW YORK 10167

OFFICE OF THE
SENIOR VICE PRESIDENT
AND GENERAL COUNSEL

October 29, 1981

Matthew L. Myers, Attorney
Division of Advertising Practices
Federal Trade Commission
Bureau of Consumer Protection
Washington, D.C. 20580

Dear Mr. Myers:

By letter of August 25, 1981, I indicated that we would at a later time state our views as to whether the change in tar and nicotine test methodology proposed by R. J. Reynolds or that proposed by Philip Morris would in our view be preferable if, indeed, any change is made at all. Having had an opportunity to review both proposed changes in some detail, it is our view that if a change is to be made, and of the two changes suggested to date, the methodology suggested by Philip Morris would be preferable.

Very truly yours,

Arnold Henson
Senior Vice President
and General Counsel

AH:JC

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CABLE ADDRESS: POWHATTAN

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BROWN & WILLIAMSON TOBACCO CORPORATION

1600 West Hill Street · P. O. Box 35090 · Louisville, Kentucky 40232

ERNEST PEPPLES
SENIOR VICE PRESIDENT
AND GENERAL COUNSEL

TELEPHONES
(502) 774-7476
(502) 774-7011

FEDERAL TRADE COMMISSION
RECEIVED
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CHAIRMAN

November 6, 1981

Mr. James C. Miller, III
Chairman
Federal Trade Commission
Pennsylvania Avenue & 6th Street, N.W.
Washington, DC 20580

Dear Mr. Miller

I am writing to call your attention to an unnecessarily cumbersome approach by the Bureau of Consumer Protection to questions concerning the Commission's cigarette testing program, and to ask you to look into the matter to see if it cannot be handled in a more practical and efficient way.

The questions about testing procedures were raised by R.J.Reynolds Tobacco Company and Philip Morris, Inc. in a transparent attempt to enlist the aid of the Commission in suppressing the competition of Brown & Williamson's successful new Barclay entry in the ultra-low "tar" market. The success of the innovative Barclay brand has posed an unwelcome threat to the ability of the two industry giants to continue to increase their dominance of virtually all segments of the cigarette market. Reynolds and Philip Morris together hold 65% of the U.S. market against our 14%.

Barclay's success is based on its unique, patented filter design which gives it a superior ability to combine good taste and easy draw with very low "tar" and nicotine delivery, characteristics that appeal to smokers. Stung by the success of this innovative cigarette, Reynolds and Philip Morris have made unprecedented requests that the Commission change its established "tar" and nicotine testing methods in a contrived manner that would penalize the innovative design of the Barclay filter and help them suppress its competitive threat to their own low-"tar" brands.

The key to the Barclay filter's superior performance lies in its horizontally grooved structure. Reynolds wants the Commission to change its testing equipment by adopting a new filter holder that exerts exceptionally high pressure on the filter, some 15 times greater than the pressure exerted by the average smoker, and consequently causes it to collapse. Not surprisingly, this

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compromises the filter's performance. Philip Morris has a different idea. It wants the Commission to place a kind of hose washer in the back of the filter holder, which will seal off the grooves and thereby overcome their effect.

~~Both proposals approach the frivolous. Since other cigarettes do~~ not employ similar grooves, their performance would not be degraded by either of these changes, which clearly have been contrived to penalize Barclay and Barclay alone. The Commission's testing procedures were developed in a collaborative effort with all members of the industry and have the confidence of both the industry and the public. Other members of the industry do not support the Reynolds and Philip Morris proposals for test changes.

We have already spent well over a million dollars in obtaining and submitting to the Bureau of Consumer Protection technical materials refuting our competitors' attacks on the Barclay filter. We have consulted with the best scientists in the country and have conducted definitive human tests through independent laboratories, while our detractors have relied exclusively on company employees. Our work confirms the view as reported to the staff by Dr. Gio Gori of the Franklin Research Institute in his oral presentation on July 9, 1981, and again in his October 22 letter based on further human tests: Barclay does not deliver more smoke than other brands rated at 1 mg. by FTC method.

We are concerned about current staff suggestions which would tend to prolong the matter and encumber it with the trappings of a large investigative proceeding, such as public notice and comment.

We believe the entire matter is one that will yield readily to practical, prompt, common-sense treatment, and we would greatly appreciate an opportunity to sit down and talk briefly to you and Mr. Muris about it before things reach the point where the Commission has committed itself and the industry to a needless expenditure of time and money.

I very much look forward to meeting with you at an early date.

Sincerely yours,

Ernest Pepples

Ernest Pepples
/dlb

cc: Mr. Timothy J. Muris

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EXHIBIT 36

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DENTIAL

Report on Barclay

by

Lynn T. Kozlowski, Ph.D.
Scientist
Addiction Research Foundation

Associate Professor
Departments of Psychology and of
Preventive Medicine and Biostatistics
University of Toronto
Toronto, Ontario
Canada

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1.0 Orientation. I have been asked to give an opinion on whether the research concerning the Barclay issue raises 'serious question' about the appropriateness of standard FTC assays of this brand. I think that serious question does exist about Barclay and, further, I think that no additional research is needed to demonstrate that Barclay presents greater risks of high tar and nicotine yields to smokers than do other ultra-low-tar brands. Ironically, the studies that are most conclusive on this point are the B&W Gori-Darby Studies: This research shows that Barclay, as used by consumers, delivers higher levels of nicotine than do other, ostensibly comparable, low-tar brands. Other studies are less conclusive, but, nonetheless, they agree in their main findings that Barclay is inappropriately assayed by the FTC method. This report is intended to provide a brief review of the studies that either (a) cause doubts about Barclay or (b) reduce doubts about Barclay.

1.1 As was pointed out by B&W, PM and Lorillard, the air-dilution systems on all ventilated-filter cigarettes can be defeated behaviorally, by means of the smokers' placement of lips or fingers. All ventilated filter cigarettes can have their air-entry holes blocked. Barclay, in addition, can have its air channels blocked (holding the filter between the teeth can certainly provide the necessary pressure)* and, further, can have its air-exit holes blocked. Barclay does appear to pose added risks of

* I think that lip pressure can cause the channels to buckle; place a Barclay carefully in your mouth and squeeze: You can 'hear-feel' the channels buckling.

hole-blocking. The magnitude of these added risks remains to be determined.

1.2 The FTC cigarette testing procedure is designed to give estimates of the delivery of tar and nicotine (and carbon monoxide) to an idealized 'average' smoker, to provide some objective basis for ranking the yields of cigarettes. The basic question of 'delivery' (or of tar and nicotine yield) refers to the amount of these toxic products reaching the mouth of the smoker. Once the smoke reaches the mouth, its fate depends on many factors that are all subject to substantial individual variation (e.g., depth of inhalation, duration of inhalation, microsomal enzymes in the liver, urinary pH, exercise).

1.3 Studies that depend on measures of nicotine can be considered approximate measures of delivery. Research by Hill & Marquardt (see appendix) indicates that fairly large differences (certainly greater than 0.1 mg) in standard FTC yields of nicotine are required, before substantial differences in cotinine levels will be found. More will be said on the Gori-Cotinine Studies in a later section of this report.

2.0 The Panel Studies - Sensory Profiles. I do not believe that any of these studies should be weighted very heavily in the FTC's decision. Even if studies on other cigarettes have shown a high correlation between perceptual judgements and tar, Barclay may violate this relationship and still be producing acceptable FTC tar estimates.

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In other words, if Barclay had genuinely succeeded in modifying the 'taste'— tar relationship, then, one would expect to find a 1 mg tar cigarette that tasted like a stronger cigarette.

3.0 <u>The "Butt" Studies</u>. A butt-nicotine study on ventilated-filter cigarettes is inadequate, if it does not allow for changes in filter-efficiency due to changes in puff-velocity and air-dilution. Therefore, the B&W studies do not provide acceptable scientific evidence on the actual delivery of Barclay or its delivery relative to other ultra-low-tar brands.

3.1 Though from a laboratory-analytical viewpoint, the PM studies are first-rate, the exact procedure seems to me to be biased against Barclay and for Cambridge. The on-line dilution measurement device provides a good measure of dilution on machine-smoked cigarettes, but it provides a limited measure of human smoking behavior.

3.2 <u>Fact</u>. On the one hand, the device protects the <u>air-entry</u> holes (e.g., on Cambridge) from being blocked with fingers or lips. Such behavioral blocking (if it occurred) would show that Barclay's competitors were also susceptible to producing a divergence between human-smoked and machine-smoked tar yields. This biases toward finding Barclay worse than the others, when in fact, Barclay and the other ultra-low tars might be alike (for the same basic reason) in commonly delivering more tar than the FTC ratings indicate. All air-dilution filters compared to non-ventilated filters may pose a risk to the integrity of the relative ranking of tar yields throughout the entire tar scale.

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3.3 Opinion. On the other hand, the on-line device may bias toward the lip draping effect. The distance between the air-entry holes and the end of the cigarette on Barclay is only 12-13 mm. The placement of the device reduces this distance by at least 1 mm. Subjects would be likely to wish to avoid touching or disturbing the apparatus with their lips, so they might place the cigarette less far into their mouths. Clearly not all smokers hold cigarettes in their mouths so that their lips drape over the edge of the end of the filter. (Recently, Winston ads, e.g., show smokers holding cigarettes between their teeth; in my Lab, I have seen lipstick stains that only cover air-entry holes and are well away from the end of the cigarette.)

3.4 The August 31, 1981 PM submission does indicate that the available length of the filter in the PM apparatus does not affect the dilution change caused by human smoking. Unfortunately, this report does not resolve the question of lip-draping or channel collapse. This study does support the PM claim that human smoking does reduce air-dilution on Barclay and increases tar-yield. (It should be noted that the B&W concerns about the subject population are legitimate.)

3.5 The finding that the other ultra-low-tar brands do not diverge from their FTC yields when smoked by people may be pre-determined in that their ventilation systems are protected by the measuring apparatus from possible behavioral interventions that would be functionally equivalent to the blocking of the

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air-exit holes on Barclay. Kozlowski et al. (Brit. J. of Addictions, in press, see Appendix) demonstrate that behavioral hole-blocking does occur in more conventional ventilated-filter cigarettes. (Compare the statements on p.42 of the October 23 submission). Note that no assertion is being made here other than <u>some</u> low-tar smokers do block ventilation holes.

3.6 Despite the 'artificiality' of the measurement apparatus, I think that the results do indicate that the air-dilution of Barclay does change when smoked by humans. The assumptions that PM makes about the 'butts' are reasonable and likely to be correct, but as B&W points out, air-dilution is not the only factor that can influence filter efficiency. A sample of consumers should be used in these studies.

4.0 <u>Subject Populations</u>. It is difficult to judge how much the subjects (employed by the tobacco companies) know of the role of air-dilution in reduced-yield cigarettes, but it is probably fair to assume that these smokers are more aware about cigarette technology that would be the general public. These subjects may be more inclined to avoid ventilation holes (e.g., on Cambridge, Now, Carleton) because they understand the implications of hole-blocking.

4.1 There is no question that behavioral defeat of dilution filters is within the competence of almost any smoker; however, it is not clear just what percentage of naive smokers regularly block ventilation holes (entry or exit holes).

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4.2 The FTC should be most interested in the yields to a regular smoker of a given brand, because this individual will be most affected by the misleading information. Studies on hole-blocking should employ smokers who have adopted the brand in question as their usual brand. Hole-blockers will be more likely to stick with an ultra-low-tar brand, because these cigarettes will be higher-yielding and more satisfying. Those who try the ultra-low tar brands, but who do not learn some form of hole-blocking, could be expected to show a higher rate of dissatisfaction with the brand. Consequently, the probability of encountering hole-blocking with a particular brand should be higher in a sample of long-term ultra-low tar smokers, than in a sample of smokers who are novice smokers of these cigarettes.

5.0 The Lorillard - Uninhaled Puff Study. This study suffers from the problems expressed in Section 4. None of the smokers were regular smokers of ultra-low-tar brands. They may know 'too much' about the function of vent-holes. Nevertheless, these results do indicate that the tar delivery of Barclay is higher than the FTC ratings suggest. Unfortunately, these results are not persuasive that other ultra-low-tar brands are not guilty of the same problem. The B&W objections to this study (cited on p.25, October 23) have almost no merit. Their own consultant (Gori) has emphasized the need for 'within subject' (repeated measure) comparisons: B&W Figure 1 presents the 'between subject' comparisons from the Lorillard study.

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6.0 Cotinine Research. Although cotinine is too far downstream from nicotine delivery to be an ideal measure of the nicotine yield of cigarettes, within-subject designs, using many repeated measures, can make cotinine an acceptable marker of nicotine intake.

6.1 The Gori-Darby Studies. Taking the findings at face value, it is not possible to judge whether these results show that Barclay is more like Cambridge and Carlton than it is like higher-yield brands. Crucial higher-yield comparisons are not made. One cannot evaluate the shape of a mathematical function by comparing only 2 points (here 0.1 mg and 0.2 mg nicotine). Although Gori raises some legitimate concerns about comparing higher-yield cigarettes to lower-yield cigarettes, the fundamental question (i.e., where does Barclay stand in relation to other brands—higher and lower) requires that at least one higher-yield cigarette be evaluated for its cotinine 'yield'. It should be noted that none of Gori's misgivings about doing higher-yield comparisons can be applied to comparisons to 0.3 or 0.4 mg nicotine cigarettes.

6.2 It is ironic that B&W would complain about the "complex formulas and abstruse statistical manipulation" of PM's butt study, and at the same time rely on the complex formulas and abstruse statistical manipulations of Dr. Darby's study. I do not think that the simulation contributes anything beyond Dr. Gori's study. Until a fuller range of nicotine yield-cotinine

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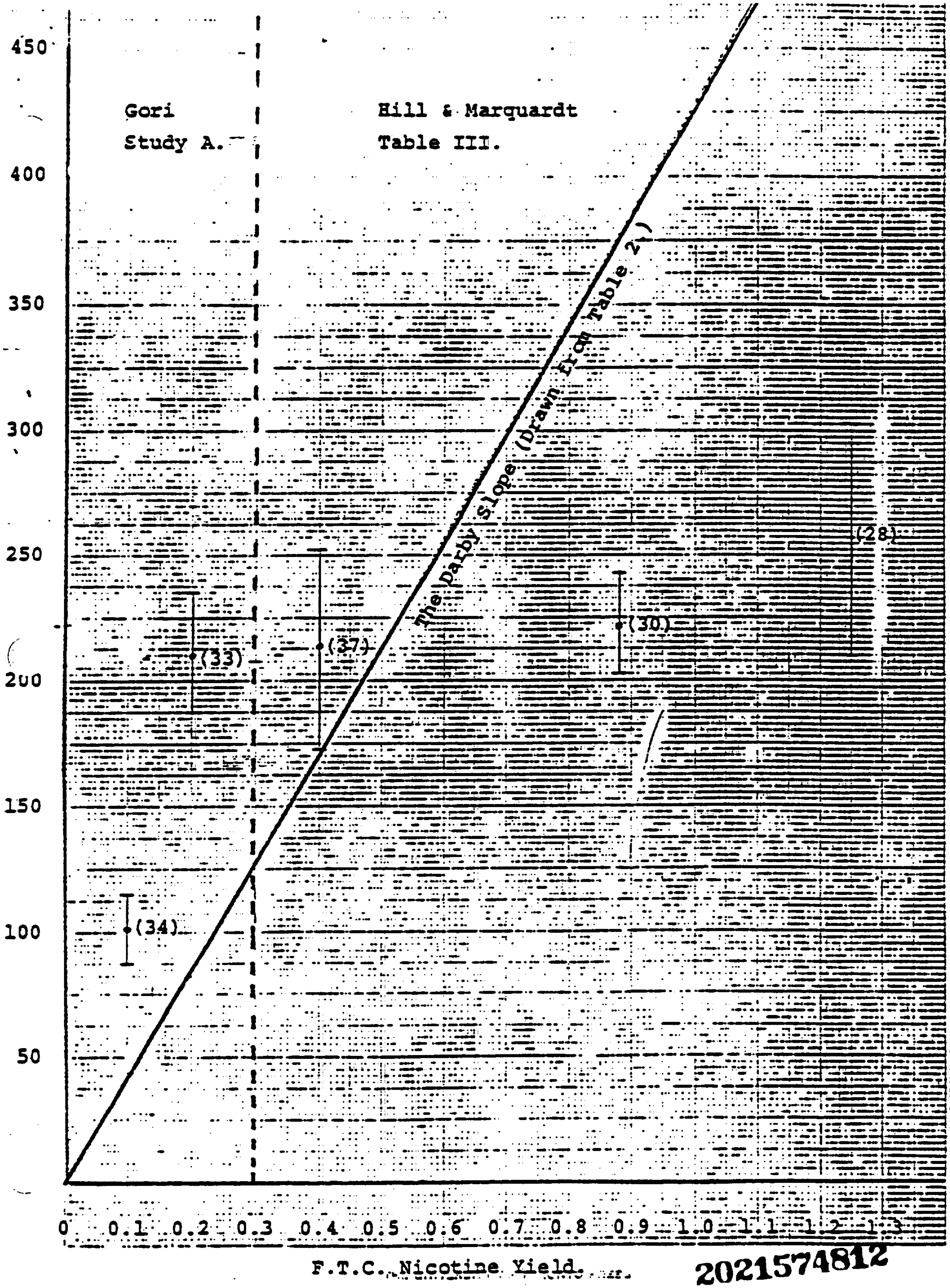
450
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200
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50
Gori
Study A.
Hill & Marquardt
Table III.
The Darby Slope (Drawn From Table 2)
(34)
(33)
(37)
(30)
(28)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
F.T.C. Nicotine Yield

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level comparisons are available, Dr. Darby's first approximation will remain largely untested.

6.3 I have prepared Figure 1 to illustrate why the interpretation of these findings (again, if taken at face value) is not at all clear. Rather than simply using arbitrary figures, I have used the results of a well-known study (although un-cited in the submissions by Gori or Darby) by Hill and Marquardt (Clinical Pharmacology and Therapeutics, May 1980, 652-658, see Appendix). Figure 1 shows the relationship between nicotine yield and cotinine levels in two studies. To the left of the dotted line is the Gori Study A; to the right of the dotted line is the Hill & Marquardt Study. (Gori Study A is used because Darby supplies the 'raw' data from it in his report and because the Darby Study depends upon Study A.) There is no way of knowing how comparable the 3 subjects from Hill & Marquardt are to the 12 subjects from the Gori Study. The Darby slope is drawn from his Table 2, rows 1 and 4: attend to the slope rather than the intercept of this line. The numbers in parenthesis are the number of cigarettes smoked per day. Cotinine values are means ± SEM.

6.4 If we assume <u>for purposes of illustration</u> that the dotted line dividing the two experiments does not exist and that each mean cotinine level is made up of measures from the same subjects, this pattern of results would suggest that Barclay is more like higher-yield cigarettes than like the 0.1 mg nicotine cigarettes. Perhaps higher-yield comparisons would show that Barclay is more like the other ultra-low tars than like the

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0.4 mg or the 1.25 mg nicotine cigarettes, but until the research is done, one (including Dr. Darby) can do little more than guess about the outcome. From a comparison of the Darby slope with the results of Hill & Marquardt, it looks as if the proposed model may be very inaccurate at higher nicotine-yield levels.

6.5 So far, I have argued that the Gori studies are inconclusive. I think that other lines of reasoning indicate that the Gori studies provide solid evidence against the B&W position. There is no valid reason to expect that a 0.1 mg and a 0.2 mg nicotine cigarette would produce reliably different cotinine levels in smokers. Measurements can be hyper-precise, i.e., too precise for the uses to which they are put. This 0.1 mg nicotine differential is too small to be behaviorally consequential. (Consider an analogy: if EPA mileage estimates showed one car to deliver 25.2 (or 25) mpg and another car to deliver 25.7 (or 26) mpg in their laboratory tests, would you expect that these cars in the hands of 40 drivers would show a significant difference in average mpg achieved?) Dr. S. Green, a researcher from the British-American Tobacco Company has written an interesting report "Ranking cigarette brands on smoke deliveries". Dr. Green concludes that "small differences in simple tables [of tar/nicotine deliveries] are meaningless" (p388)(see Appendix).

6.8 For anyone aware of the variability of human smoking behavior (cf. p42 of the October 23 submission), it should be apparent that a difference between a 0.1 mg and a 0.2 mg cigarette would be very difficult to measure outside of the smoking-machine laboratory. (See the discussion by Kozlowski, <u>Addictive Behaviors</u>,

p214, in Appendix, on how variability in human smoking can make it difficult to detect a difference in actual yields to smokers, unless large differences in FTC yield are at issue).

6.9 There is no reason to doubt the appropriateness of the most recent FTC ratings of Cambridge, Carlton, and Barclay: these figures show, in agreement with Gori and B&W, cigarettes that yield 0.1, 0.1 and 0.2 mg nicotine, respectively (see Table 1). If one considers the FTC results to the second decimal place and considers the variance of these scores, an interesting fact emerges. Though these scores can be rounded to give yields that differ by 0.10 units, in fact, 0.11 mg cigarettes (Cambridge and Carlton) and 0.15 mg nicotine cigarettes (Barclay) differ by only 0.04 mg. (Darby, then, was actually dealing with an FTC yield difference that he over-estimated by 60%.) This difference is not statistically reliable ($\underline{t}$ (38) = 1.2, $p > .30$). This means that the FTC smoking machines did not distinguish between these '0.1' and '0.2' brands at an accepted level of statistical significance. A perusal of Table 1 should also confirm that the smoking machines do not reliably distinguish the brands in question: Note that, to Lorillard, Carlton and Barclay both deliver '0.2' mg of nicotine and that, to PM, Cambridge and Carlton both deliver '0.2' mg of nicotine. Table 1 also shows that the 'rounding error' can be a serious problem when dealing with these small doses. If smoking-machines have difficulty evaluating this miniscule difference in nicotine yield (in an environment that is temperature and humidity controlled), how can smokers have

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so little difficulty in distinguishing these cigarettes? Of course, smokers could not be expected to show a difference that the machines have such difficulty in showing: When smoking Barclay, the smokers must have been getting substantially more nicotine from this brand than from the other ultra-low-tar brands.

7.0 In other words, Gori has shown that brands that do not differ significantly in nicotine yields on smoking-machines, do differ significantly in cotinine levels in smokers. The obvious explanation for this finding is that Barclay delivers much more nicotine than do the other nominally ultra-low-tar brands. Barclay stands alone among these ultra-low yield cigarettes. It delivers more cotinine than do Cambridge, Carlton and NOW 0.1 mg cigarettes).

7.1 To summarize, I think that Barclay is not properly assayed by the FTC method and that it delivers tar and nicotine to smokers out of proportion to its ranking on the FTC lists. It should be noted that all ventilated filter cigarettes (see paragraph 1.1) are subject to a similar violation of the integrity of the rankings, but that Barclay (as supported by the PM air-dilution studies, the Lorillard Uninhaled-Puff Study, and the above analysis of the Gori Studies) is significantly more prone to this violation than are conventional ventilated-filter cigarettes.

8.0 Consumers should be warned about the special risks of using ventilated-filter cigarettes (including Barclay) and about the higher risks of the Barclay-type filter.

TABLE 1

BRAND	LAB	FTC TAR EXACT	FTC TAR ROUNDED	FTC NICOTINE EXACT	FTC NICOTINE ROUNDED	PUFF COUNT
Barclay	RJR	1.6	2	0.17	0.2	8.5
	PM	2.1	2	0.28	0.3	8.0
	LOR	0.9	1	0.20	0.2	—
	FTC			0.15 (±0.03)*	0.2	
Cambridge	RJR	0.6	1	0.11	0.1	7.6
	PM	1.3	1	0.17	0.2	7.0
	LOR	—	—	—	—	—
	FTC			0.11 (±.01)	0.01	
Carlton	RJR	0.6	1	0.11	0.1	6.8
	PM	0.9	1	0.18	0.2	7.4
	LOR	0.5	1	0.15	0.2	—
	FTC			0.11 (±.01)	.01	
NOW	RJR	2.5	3.0	0.23	0.2	7.2
	PM	—	—	—	—	—
	LOR	0.9	1.0	0.18	0.2	—
	FTC	—	—	0.22 (±.01)	0.2	—

* Twice Variance

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3.3 Opinion. On the other hand, the on-line device may bias toward the lip draping effect. The distance between the air-entry holes and the end of the cigarette on Barclay is only 12-13 mm. The placement of the device reduces this distance by at least 1 mm. Subjects would be likely to wish to avoid touching or disturbing the apparatus with their lips, so they might place the cigarette less far into their mouths. Clearly not all smokers hold cigarettes in their mouths so that their lips drape over the edge of the end of the filter. (Recently, Winston ads, e.g., show smokers holding cigarettes between their teeth; in my Lab, I have seen lipstick stains that only cover air-entry holes and are well away from the end of the cigarette.)

3.4 The August 31, 1981 PM submission does indicate that the available length of the filter in the PM apparatus does not affect the dilution change caused by human smoking. Unfortunately, this report does not resolve the question of lip-draping or channel collapse. This study does support the PM claim that human smoking does reduce air-dilution on Barclay and increases tar-yield. (It should be noted that the B&W concerns about the subject population are legitimate.)

3.5 The finding that the other ultra-low-tar brands do not diverge from their FTC yields when smoked by people may be pre-determined in that their ventilation systems are protected by the measuring apparatus from possible behavioral interventions that would be functionally equivalent to the blocking of the

air-exit holes on Barclay. Kozlowski et al. (Brit. J. of Addictions, in press, see Appendix) demonstrate that behavioral hole-blocking does occur in more conventional ventilated-filter cigarettes. (Compare the statements on p.42 of the October 23 submission). Note that no assertion is being made here other than <u>some</u> low-tar smokers do block ventilation holes.

3.6 Despite the 'artificiality' of the measurement apparatus, I think that the results do indicate that the air-dilution of Barclay does change when smoked by humans. The assumptions that PM makes about the 'butts' are reasonable and likely to be correct, but as B&W points out, air-dilution is not the only factor that can influence filter efficiency. A sample of consumers should be used in these studies.

4.0 <u>Subject Populations</u>. It is difficult to judge how much the subjects (employed by the tobacco companies) know of the role of air-dilution in reduced-yield cigarettes, but it is probably fair to assume that these smokers are more aware about cigarette technology that would be the general public. These subjects may be more inclined to avoid ventilation holes (e.g., on Cambridge, Now, Carleton) because they understand the implications of hole-blocking.

4.1 There is no question that behavioral defeat of dilution filters is within the competence of almost any smoker; however, it is not clear just what percentage of naive smokers regularly block ventilation holes (entry or exit holes).

4.2 The FTC should be most interested in the yields to a regular smoker of a given brand, because this individual will be most affected by the misleading information. Studies on hole-blocking should employ smokers who have adopted the brand in question as their usual brand. Hole-blockers will be more likely to stick with an ultra-low-tar brand, because these cigarettes will be higher-yielding and more satisfying. Those who try the ultra-low tar brands, but who do not learn some form of hole-blocking, could be expected to show a higher rate of dissatisfaction with the brand. Consequently, the probability of encountering hole-blocking with a particular brand should be higher in a sample of long-term ultra-low tar smokers, than in a sample of smokers who are novice smokers of these cigarettes.

5.0 The Lorillard - Uninhaled Puff Study. This study suffers from the problems expressed in Section 4. None of the smokers were regular smokers of ultra-low-tar brands. They may know 'too much' about the function of vent-holes. Nevertheless, these results do indicate that the tar delivery of Barclay is higher than the FTC ratings suggest. Unfortunately, these results are not persuasive that other ultra-low-tar brands are not guilty of the same problem. The B&W objections to this study (cited on p.25, October 23) have almost no merit. Their own consultant (Gori) has emphasized the need for 'within subject' (repeated measure) comparisons: B&W Figure 1 presents the 'between subject' comparisons from the Lorillard study.

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6.2 It is ironic that B&W would complain about the "complex formulas and abstruse statistical manipulation" of PM's butt study, and at the same time rely on the complex formulas and abstruse statistical manipulations of Dr. Darby's study. I do not think that the simulation contributes anything beyond Dr. Gori's study. Until a fuller range of nicotine yield-cotinine

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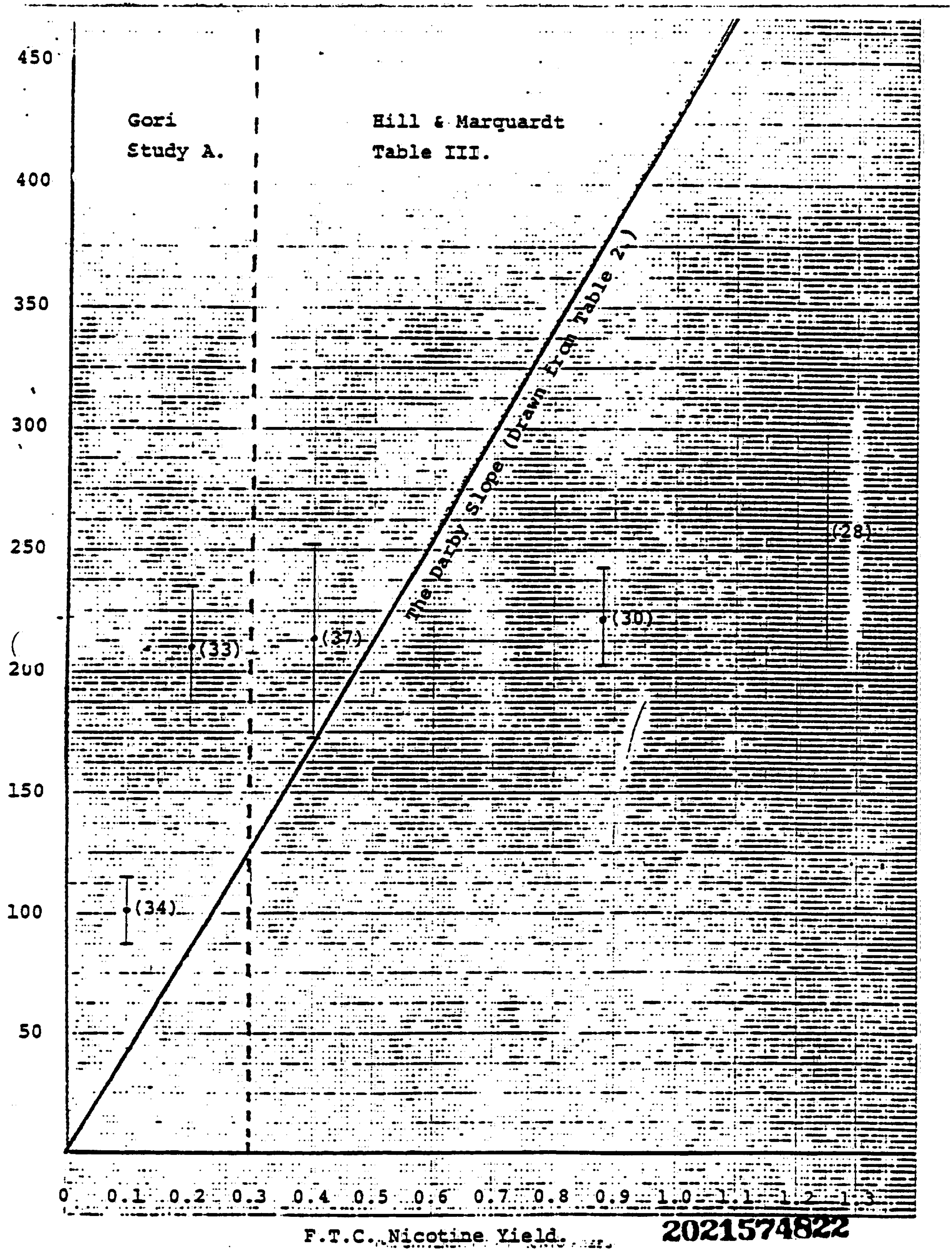

450
400
350
300
250
200
150
100
50
Gori
Study A.
Hill & Marquardt
Table III.
The Darby Slope (Drawn From Table 2)
(33)
(37)
(30)
(28)
(34)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
F.T.C. Nicotine Yield.

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level comparisons are available, Dr. Darby's first approximation will remain largely untested.

6.3 I have prepared Figure 1 to illustrate why the interpretation of these findings (again, if taken at face value) is not at all clear. Rather than simply using arbitrary figures, I have used the results of a well-known study (although un-cited in the submissions by Gori or Darby) by Hill and Marquardt (Clinical Pharmacology and Therapeutics, May 1980, 652-658, see Appendix). Figure 1 shows the relationship between nicotine yield and cotinine levels in two studies. To the left of the dotted line is the Gori Study A; to the right of the dotted line is the Hill & Marquardt Study. (Gori Study A is used because Darby supplies the 'raw' data from it in his report and because the Darby Study depends upon Study A.) There is no way of knowing how comparable the 3 subjects from Hill & Marquardt are to the 12 subjects from the Gori Study. The Darby slope is drawn from his Table 2, rows 1 and 4: attend to the slope rather than the intercept of this line. The numbers in parenthesis are the number of cigarettes smoked per day. Cotinine values are means ± SEM.

6.4 If we assume <u>for purposes of illustration</u> that the dotted line dividing the two experiments does not exist and that each mean cotinine level is made up of measures from the same subjects, this pattern of results would suggest that Barclay is more like higher-yield cigarettes than like the 0.1 mg nicotine cigarettes. Perhaps higher-yield comparisons would show that Barclay is more like the other ultra-low tars than like the

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0.4 mg or the 1.25 mg nicotine cigarettes, but until the research is done, one (including Dr. Darby) can do little more than guess about the outcome. From a comparison of the Darby slope with the results of Hill & Marquardt, it looks as if the proposed model may be very inaccurate at higher nicotine-yield levels.

6.5 So far, I have argued that the Gori studies are inconclusive. I think that other lines of reasoning indicate that the Gori studies provide solid evidence against the B&W position. There is no valid reason to expect that a 0.1 mg and a 0.2 mg nicotine cigarette would produce reliably different cotinine levels in smokers. Measurements can be hyper-precise, i.e., too precise for the uses to which they are put. This 0.1 mg nicotine differential is too small to be behaviorally consequential. (Consider an analogy: if EPA mileage estimates showed one car to deliver 25.2 (or 25) mpg and another car to deliver 25.7 (or 26) mpg in their laboratory tests, would you expect that these cars in the hands of 40 drivers would show a significant difference in average mpg achieved?) Dr. S. Green, a researcher from the British-American Tobacco Company has written an interesting report "Ranking cigarette brands on smoke deliveries". Dr. Green concludes that "small differences in simple tables [of tar/nicotine deliveries] are meaningless" (p388)(see Appendix).

6.8 For anyone aware of the variability of human smoking behavior (cf. p42 of the October 23 submission), it should be apparent that a difference between a 0.1 mg and a 0.2 mg cigarette would be very difficult to measure outside of the smoking-machine laboratory. (See the discussion by Kozlowski, Addictive Behaviors,

p214, in Appendix, on how variability in human smoking can make it difficult to detect a difference in actual yields to smokers, unless large differences in FTC yield are at issue).

6.9 There is no reason to doubt the appropriateness of the most recent FTC ratings of Cambridge, Carlton, and Barclay: these figures show, in agreement with Gori and B&W, cigarettes that yield 0.1, 0.1 and 0.2 mg nicotine, respectively (see Table 1). If one considers the FTC results to the second decimal place and considers the variance of these scores, an interesting fact emerges. Though these scores can be rounded to give yields that differ by 0.10 units, in fact, 0.11 mg cigarettes (Cambridge and Carlton) and 0.15 mg nicotine cigarettes (Barclay) differ by only 0.04 mg. (Darby, then, was actually dealing with an FTC yield difference that he over-estimated by 60%.) This difference is not statistically reliable (t (38) = 1.2, $p > .30$). This means that the FTC smoking machines did not distinguish between these '0.1' and '0.2' brands at an accepted level of statistical significance. A perusal of Table 1 should also confirm that the smoking machines do not reliably distinguish the brands in question: Note that, to Lorillard, Carlton and Barclay both deliver '0.2' mg of nicotine and that, to PM, Cambridge and Carlton both deliver '0.2' mg of nicotine. Table 1 also shows that the 'rounding error' can be a serious problem when dealing with these small doses. If smoking-machines have difficulty evaluating this miniscule difference in nicotine yield (in an environment that is temperature and humidity controlled), how can smokers have

so little difficulty in distinguishing these cigarettes? Of course, smokers could not be expected to show a difference that the machines have such difficulty in showing: When smoking Barclay, the smokers must have been getting substantially more nicotine from this brand than from the other ultra-low-tar brands.

7.0 In other words, Gori has shown that brands that do not differ significantly in nicotine yields on smoking-machines, do differ significantly in cotinine levels in smokers. The obvious explanation for this finding is that Barclay delivers much more nicotine than do the other nominally ultra-low-tar brands. Barclay stands alone among these ultra-low yield cigarettes. It delivers more cotinine than do Cambridge, Carlton and NOW 0.1 mg cigarettes).

7.1 To summarize, I think that Barclay is not properly assayed by the FTC method and that it delivers tar and nicotine to smokers out of proportion to its ranking on the FTC lists. It should be noted that all ventilated filter cigarettes (see paragraph 1.1) are subject to a similar violation of the integrity of the rankings, but that Barclay (as supported by the PM air-dilution studies, the Lorillard Uninhaled-Puff Study, and the above analysis of the Gori Studies) is significantly more prone to this violation than are conventional ventilated-filter cigarettes.

8.0 Consumers should be warned about the special risks of using ventilated-filter cigarettes (including Barclay) and about the higher risks of the Barclay-type filter.

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EXHIBIT 37

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ROSWELL PARK MEMORIAL INSTITUTE

Department of Health ■ State of New York

666 Elm Street ■ Buffalo, New York, 14263

David Axelrod, M.D.
Commissioner of Health

Gerald P. Murphy, M.D., D.Sc.
Institute Director

November 12, 1981

Mr. Matthew L. Myers
Division of Advertising Practices
Bureau of Consumer Protection
Federal Trade Commission
Washington, D.C. 20580

Dear Mr. Myers:

I have examined carefully the material that you brought to Buffalo indicated in your Table of Contents as Items 1 through 16, together with the more recent submission containing a letter and Attachment A from Mr. Witt; a letter from Dr. Gori addressed to Mr. London; a submission by Paul, Weiss, Rifkind, Wharton & Garrison; together with a technical appendix and technical report prepared by Dr. Kamm. The total body of material does not convince me that the present methodology for testing cigarettes for tar and nicotine ought to be changed at this time. However, the issues raised by RJR and Philip Morris and supported by Lorillard are sufficiently important that the Commission ought to encourage resolution of the problem in a manner that will be acceptable after critical scientific review.

There are two questions that have not been adequately answered by the submissions to the Commission. To what extent is the smoke of Barclay cigarettes diluted? How reliable are conclusions that could be drawn from the Gori cotinine study?

The dilution data provided chiefly by Philip Morris and supported by Reynolds are highly suggestive. On the other hand, the studies suffer from two flaws. The use of a device, particularly one as bulky as the PPA, may introduce a distortion in the manner in which cigarettes are smoked. This objection is met, in part, by internal controls, but remains a problem. More importantly, the panel used for the tests was potentially biased. Even if it were not so, the structure of a panel imposes misgivings. To quote from page 10 of the August 19 submission by RJR, they..."found isolated panel tests to be variable and unreliable unless very careful tests are performed under highly controlled conditions". With reservations expressed by one of the supporters, it is difficult to accept panel data collected under conditions where bias is possible and perhaps unavoidable.

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The Gori cotinine study purports to show that regardless of how the cigarette is smoked, the same amount of smoke is retained by the consumer of Barclay cigarettes as by smokers of Cambridge, Carlton or Now cigarettes. If so, the values obtained using the FTC smoking machine parameters are a fair measure of the relative risk to smokers of those four cigarettes. The Gori study is flawed, insofar as reported, in two major respects. There is no indication of brand of cigarettes smoked by the subjects prior to enrollment in the study. This is important because smokers of 1 mg. cigarettes may be habituated to substantially different deliveries of nicotine. For example, a Barclay smoker might be expected to compensate on being switched to a brand such as Cambridge or Carlton delivering only two-thirds as much nicotine. If so, such a smoker would increase the efficiency of tar recovery from the low-nicotine cigarettes, reducing any differences that might otherwise appear. That such compensation could occur is explicitly accepted in the design of the study itself. The baseline cotinine values suggest that a problem of this sort might be involved in the study. The second flaw in the Gori study is that there was an insufficient range of cigarette delivery to permit evaluation of dose-depedence of the cotinine levels. Such information is not necessary for the main thrust of the Gori argument. But if it were available, it would be useful in determining whether the Gori tests could detect differences in cigarette delivery, where such differences are detected in FTC tests.

How might these two questions be fully resolved? It may be possible to design a dilution study that would be acceptable to both industry and non-industry scientists. Design of such a study should almost certainly require participation of experts who are familiar with panel-testing of cigarettes. It may be possible to measure changes in blood levels of cotinine in smokers of moderate tar delivery cigarettes (e.g. 4-8 mg. tar) who switch to either Barclay or one of the other brands delivering from .1 to .3 mg. of nicotine. This would tell us whether, in this test, Barclay differs from moderate yield and low yield cigarettes.

I look forward to receiving more information with respect to these matters as it is available. A final report will be submitted at that time.

Sincerely yours,

Fred G. Bock

Fred G. Bock, Ph.D.
Director
Orchard Park Laboratories

FGB:DB

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EXHIBIT 38

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OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

November 13, 1981

Mr. Matthew L. Myers
Division of Advertising Practices
Bureau of Consumer Protection
Federal Trade Commission
414 11th St. N.W.
Rm. 6124
Washington, DC 20580

Dear Mr. Myers:

I have reviewed the information provided by your office concerning the suitability of the current FTC cigarette testing method for determining the tar delivery of the Barclay cigarette relative to that delivered by other name brand cigarettes. Each study for which adequate data has been made available to assess can be challenged on the basis of possible bias introduced by the experimental apparatus required or by the panel selected or on the basis of questionable experimental method. The issue, whether Barclay performs disproprotionately different than do other products when comparing FTC methodology and human smoking, may be impossible to resolve with absolute certainty. Current methodologies do not allow an unambiguous measure of human smoking practice.

The crucial point, in my opinion, is the well-illustrated (and generally well-known in the tobacco science community) influence of dilution on tar delivery for "ultra-low tar" cigarettes. Circumventing the dilution mechanism provides a very significant increase in tar delivery. Any air dilution mechanism used with any brand of cigarettes can be circumvented. The Barclay mechanism would seem more readily manipulated than those used on other brands if only because the primary dilution channels cannot be avoided. Blockage by crushing or by contact with the smokers lips would certainly yield a smoke richer in tar than if blockage did not occur.

No unambiguous evidence is presented to prove that blockage does or does not occur. At this stage in my review, however, I find tne results of the "butt studies" (by both Philip Morris and Brown and Williamson) to suggest a disproportionate increase in tar delivery by the Barclay comparing FTC and the human smoking experience. As such, I believe the issue raised by the R. J. Reynolds Tobacco Company is worthy of the Commissions attention.

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Additonal visual observation and perhaps ventillation measurements of butts left by smokers of Barclay and other low tar brands would add to the data base. A repeated butt study which incorporates the larger and more unbiased pool of participants as used by Brown and Williamson with measures of rod flow rate and ventillation as used by Philip Morris might also be helpful. The crucial experiment, in my opinion, is one which determines whether channel collapse or blockage occurs unavoidably during normal human smoking. It is not obvious, however, how this can be measured.

I hope that these comments will be of some help to your deliberations.

Sincerely,

M R Guerin

Michael R. Guerin, Head
Bio/Organic Analysis Section
Analytical Chemistry Division

MRG:pjm

cc: T. B. Owen

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EXHIBIT 39

2021574833

LAW OFFICES
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November 17, 1981

COPY

HAND DELIVERY

James C. Miller, III
Chairman
Federal Trade Commission
Pennsylvania Avenue & 6th Street, N.W.
Washington, D. C. 20580

Dear Mr. Chairman:

We have reviewed the October 23rd submission of Brown & Williamson. R. J. Reynolds has obviously not had sufficient time to conduct an in-depth analysis of the technical data presented, although its Research and Development Department has concluded that much of Brown & Williamson's data will not withstand even limited scrutiny. In light of the advice from the Commission that the staff is to have recommendations to the Commission by November 20, however, R. J. Reynolds is not now submitting a technical response but reserves its right to do so in the future.

Faulty scientific analysis is not the only difficulty with Brown & Williamson's submission. The first two pages of the submission contain what appears to be a quotation, but in fact is not cited as such. We have reviewed the source of this quotation and note that it is an excerpt from the "Statement of Considerations" presented when the Commission, in 1967, originally directed its staff to use the Cambridge Filter Method. As such, it was part of a submission by the Federal Trade Commission to the House Committee on Interstate and Foreign Commerce on April 22, 1969. Conveniently, Brown & Williamson has failed to quote the first paragraph:

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"Statement of Considerations

In determining the foregoing procedures, the Commission relied substantially upon a record including written presentation by interested persons and oral testimony offered at a public hearing on November 30, 1966, which was held 'to assist the Commission in determining what action, if any, should be taken in the public interest with respect to modifying or amplifying the Cambridge Filter Method...and the form in which test results should be expressed.' At the hearing the Commission received numerous submissions reflecting a variety of modifications of the Cambridge Filter Method that have been adopted by different groups engaged in testing cigarettes. No test can precisely duplicate conditions of actual human smoking and, within fairly wide limits, no one method can be said to be either 'right' or 'wrong'. The Commission considers it most important that the test results be based on a reasonable standardized method and that they be capable of being presented to the public in a manner that is readily understandable. Although minor variations may not make one testing method 'better' than another, the public interest requires that all tests results presented to the public be based on a uniform method used by all laboratories. Use of more than one testing method would produce different results which would only serve to confuse or mislead the public." [Emphasis supplied] [Hearings on H.R. 643, H.R. 1237, H.R. 3055, and H.R. 6543 Before the House Comm. on Interstate and Foreign Commerce, 91st Cong., 1st Sess., ser. 91-11 at 459-460 (1969)].

From the preceding, it is clear that from the original decision to use the Cambridge Filter Method, the Commission was aware that the method could be employed in "numerous" ways that may present only "minor variations" which do not make one version better than another. Even in 1967, the Commission recognized

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that the most important characteristics of the testing method are that it be "standardized" and be capable of presentation in an "understandable" fashion. We submit that, as far as the Barclay is concerned, the "tar" delivery figures which would be published by the Commission under present testing methods are far from "understandable."

The submission by Brown & Williamson, with its voluminous data, is an obvious attempt to obfuscate the real issue. This issue is simple: The current testing methodology does not work. This is something beyond a "minor variation." Therefore, what should be done to remedy the problem? The Barclay filter simply fools the Commission's machine.

The Reynolds' proposal does not seek to replicate human smoking. The Filtrona holder substantially reproduces the same results for all cigarettes, filter or not, as the Cambridge holder, except for the Barclay. This patent inconsistency destroys the integrity of the Cambridge as a norm for judging the "tar" and nicotine content of all brands. The Barclay filter makes illusory the possibility of a common comparison of all brands of cigarettes by the Commission in its testing, and by consumers in their selection. The Barclay filter simply delivers more of the advertised smoke constituents to the smoker, whether he or she wants it or not.

The problem before the Commission is this: Can the FTC accept knowingly a faulty testing methodology? The answer is obvious.

Very truly yours,

RAGAN & MASON

William F. Ragan

cc: Commissioner David A. Clanton
Commissioner Michael Pertschuk
Commissioner Patricia P. Bailey
Matthew L. Myers, Esquire

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EXHIBIT 40

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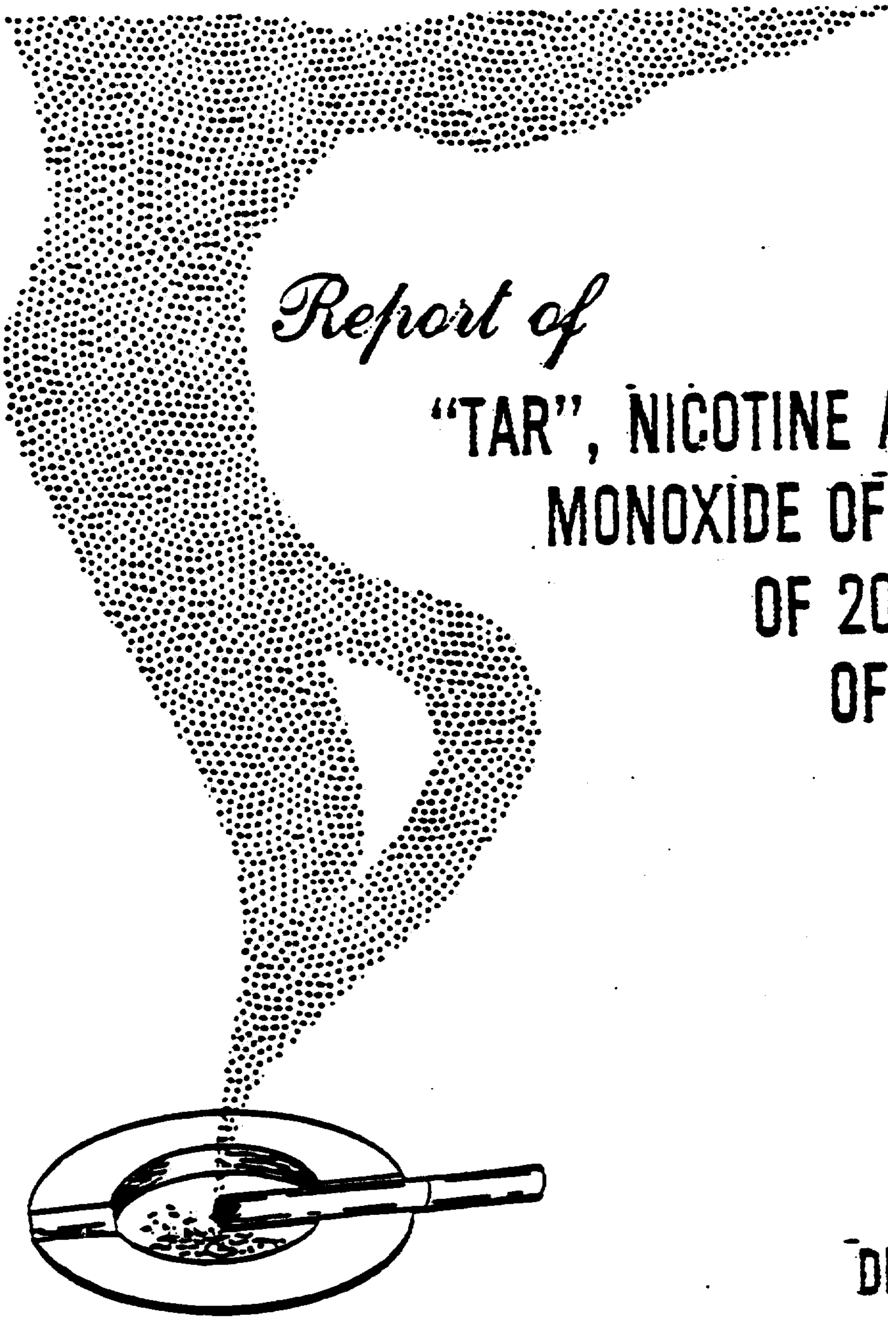
Federal Trade Commission



Report of

"TAR", NICOTINE AND CARBON MONOXIDE OF THE SMOKE OF 200 VARIETIES OF CIGARETTES

DECEMBER 1981

2021574838

REPORT OF "TAR", NICOTINE AND CARBON MONOXIDE CONTENT OF THE SMOKE OF 200 VARIETIES OF CIGARETTES

December 1981

The Federal Trade Commission's Laboratory has determined the "tar" (dry particulate matter), total alkaloid (reported as nicotine) and carbon monoxide content of 200 varieties of cigarettes. The laboratory utilized the Cambridge filter method with the following specifications as set forth in the Commission's announcement of July 31, 1967:

1. Smoke cigarettes to a 23 mm. butt length, or to the length of the filter and overwrap plus 3 mm. if in excess of 23 mm.

2. Base results on a test of approximately 100 cigarettes per brand, or type.

3. Cigarettes to be tested will be selected on a random basis, as opposed to "weight selection".

4. Determine particulate matter on a "dry" basis employing the gas chromatography method published by C. H. Sloan and B. J. Sublett in Tobacco Science 9, page 70, 1965, as modified by F. J. Schultz' and A. W. Spears' report published in Tobacco Vol. 162, No. 24, page 32, dated June 17, 1966, to determine the moisture content.

5. Determine and report the "tar" content after subtracting moisture and alkaloids (as nicotine) from particulate matter.

6. Carbon Monoxide is determined by non-dispersal infrared spectrophotometer.

Concerning the 200 varieties tested, 15 were capable of being smoked to 23 mm. The butt length of the other 185 varieties tested ranged from 24.1 mm. to an average of between 46.6 to 50.0 mm. The butt lengths of 159 of the 200 varieties tested exceed 30 mm.

The samples used were obtained by attempting to purchase two packages of each variety of cigarettes as distributed by domestic cigarette manufacturers during March and April 1981 in each of 50 geographic locations throughout the country. All varieties of cigarettes were not available in each of the 50 geographic locations and in these instances, one or more additional packages of cigarettes

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were purchased in those geographic locations where respective varieties were available. The samples utilized in the tests were representative of the 200 varieties of cigarettes as available throughout the country at the time of purchase.

In the table listing the cigarette varieties in alphabetical order the "tar" and carbon monoxide content is reported to the nearest 1/10 milligram and the nicotine to the nearest 1/100 milligram, each with appropriate statistical values. The average weight is reported in grams per cigarette and the butt length range to the nearest 1/10 millimeter. In all other tables the average weight and butt length columns and the figures representing the standard deviation of the mean have been eliminated. The "tar" and carbon monoxide figures have been rounded to the nearest milligram (0.5 milligrams and greater rounded up, 0.4 milligrams and less rounded down) and the nicotine figures have been rounded to the nearest tenth of a milligram (0.05 milligrams and greater rounded up, 0.04 milligrams and less rounded down). Three tables respectively list varieties in increasing order of "tar" values, in increasing order of nicotine values and in increasing order or carbon monoxide values. Accordingly, "tar", nicotine and carbon monoxide figures in the tables and list represent rounded off averages without indication of their precision.

A group of cigarette companies has filed a complaint with the Commission alleging that the current cigarette testing methodology does not accurately assess the "tar" and nicotine that Barclay cigarettes deliver relative to the "tar" and nicotine that other cigarette brands deliver. The complainant cigarette companies further allege that Barclay, a 1 mg. cigarette under the current FTC method, delivers more "tar" to the smoker than do other 1 mg. "tar" cigarette brands.

The complainant cigarette companies state that a cigarette manufacturer can reduce the "tar" delivery of a cigarette by a variety of different methods. One way to decrease "tar" delivery involves diluting the cigarette smoke inhaled with air brought into the filter through some form of ventilation. The higher the percentage diluted air inhaled, the lower the "tar" delivery. Methods to increase the amount of ventilation or air dilution vary from brand to brand. Many low "tar" cigarettes have a filter surrounded by porous paper with one or more rows of ventilating holes encircling the filter. When the filter is puffed, air enters the filter through the ventilation holes where it mixes with the smoke.

In the Barclay filter, air entering the ventilation holes travels to the smoker's mouth through four grooves in the filter. The complainant cigarette companies allege that when consumers smoke Barclay cigarettes, the four grooves either collapse or are in some way blocked. When tested in the FTC laboratory using the current cigarette holder, however, the companies allege that the grooves do not collapse and are not blocked. Thus, it is contended that the Commission's current testing methodology does not accurately measure the relative level of "tar" delivered by Barclay to smokers when

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compared with other 1 mg. "tar" cigarettes. The Commission is currently investigating these allegations, and has not made a final determination on the merits of this complaint. An asterisk is appended to the test scores included in this report that this investigation may affect.

It also should be noted that cigarette brands which recorded "tar" scores below 0.5 mg., nicotine below 0.05 mg. and carbon monoxide below 0.5 mg. per cigarette in this test are recorded in the accompanying tables as <0.5 mg. "tar," <0.05 mg. nicotine and <0.5 mg. carbon monoxide. The tables do not differentiate between these cigarettes because the current, approved testing methodology is not sensitive enough to differentiate between cigarettes at these levels.

TAR(1), NICOTINE(2) AND CARBON MONOXIDE OF TWO-HUNDRED (200) DOMESTIC CIGARETTES

BRAND	TYPE(3)		AVERAGE WEIGHT(4)	BUTT LENGTH(5)	TPM DRY(1)*	NICOTINE*	CARBON MONOXIDE
Alpine	F. M. SP.	85mm	0.9753	28.1 - 29.5mm	13.9 ± 0.5	0.89 ± 0.02	13.4 ± 0.5
American Lights 120's	F. SP.	120mm	1.1550	46.6 - 50.0mm	7.7 ± 0.3	0.70 ± 0.02	8.5 ± 0.4
American Lights 120's	F. M. SP.	120mm	1.1983	47.0 - 48.4mm	7.5 ± 0.3	0.67 ± 0.03	8.4 ± 0.4
Arctic Lights	F. M. SP.	85mm	1.0191	31.5 - 34.0mm	7.5 ± 0.4	0.65 ± 0.02	8.5 ± 0.4
Arctic Lights 100's	F. M. SP.	100mm	1.1659	32.8 - 36.8mm	7.4 ± 0.4	0.64 ± 0.03	9.2 ± 0.4
Barclay 6/	F. HP.	80mm	0.8249	33.8 - 36.5mm	0.7 ± 0.2	0.15 ± 0.02	1.0 ± 0.2
Barclay 6/	F. SP.	85mm	0.8482	33.6 - 36.1mm	0.8 ± 0.4	0.15 ± 0.03	1.1 ± 0.2
Barclay 100's 6/	F. SP.	100mm	1.0673	37.6 - 39.9mm	2.2 ± 0.2	0.26 ± 0.02	2.2 ± 0.2
Belair	F. M. SP.	85mm	0.9531	31.6 - 33.9mm	8.2 ± 0.3	0.72 ± 0.02	9.1 ± 0.4
Belair 100's	F. M. SP.	100mm	1.1394	37.2 - 39.5mm	8.4 ± 0.3	0.64 ± 0.02	10.1 ± 0.5
Benson & Hedges	Reg. F. HP.	70mm	0.9696	32.4 - 33.8mm	**	0.10 ± 0.02	1.2 ± 0.1
Benson & Hedges	F. HP.	85mm	1.0332	31.8 - 33.4mm	14.9 ± 0.4	1.18 ± 0.03	12.3 ± 0.3
Benson & Hedges 100's	F. HP.	100mm	1.1087	33.6 - 35.5mm	16.0 ± 0.5	1.07 ± 0.04	15.6 ± 0.4
Benson & Hedges 100's	F. M. HP.	100mm	1.1168	33.8 - 35.8mm	15.6 ± 0.5	1.05 ± 0.03	15.0 ± 0.5
Benson & Hedges 100's	F. SP.	100mm	1.1123	32.8 - 35.5mm	16.4 ± 0.4	1.09 ± 0.03	16.3 ± 0.4
Benson & Hedges 100's	F. M. SP.	100mm	1.1304	33.9 - 35.4mm	15.8 ± 0.4	1.06 ± 0.03	16.6 ± 0.4
Benson & Hedges Lights 100's	F. HP.	100mm	1.0905	37.9 - 40.0mm	10.6 ± 0.3	0.76 ± 0.02	11.3 ± 0.4
Benson & Hedges Lights 100's	F. M. HP.	100mm	1.1176	38.5 - 39.6mm	9.8 ± 0.3	0.72 ± 0.02	10.6 ± 0.3
Benson & Hedges Lights 100's	F. SP.	100mm	1.1423	37.9 - 39.9mm	10.3 ± 0.2	0.75 ± 0.02	12.9 ± 0.4
Benson & Hedges Lights 100's	F. M. SP.	100mm	1.1225	37.5 - 40.0mm	9.9 ± 0.5	0.73 ± 0.03	11.9 ± 0.5
Bull Durham	F. SP.	85mm	1.2040	26.0 - 27.3mm	29.1 ± 0.6	1.94 ± 0.05	23.8 ± 0.6
Cambridge	F. HP.	85mm	0.8695	38.3 - 39.5mm	**	**	**
Cambridge	F. SP.	85mm	0.8534	34.4 - 35.2mm	**	0.11 ± 0.01	1.1 ± 0.1
Cambridge 100's	F. SP.	100mm	0.9935	37.5 - 40.3mm	2.9 ± 0.3	0.31 ± 0.02	4.8 ± 0.3
Camel	Reg. NF. SP.	70mm	0.8755	23mm	20.6 ± 0.6	1.42 ± 0.03	12.5 ± 0.5
Camel	F. SP.	85mm	0.9712	26.9 - 28.0mm	16.0 ± 0.5	1.18 ± 0.03	16.0 ± 0.7
Camel Lights	F. HP.	80mm	0.9109	29.0 - 30.7mm	6.5 ± 0.3	0.63 ± 0.03	6.6 ± 0.4
Camel Lights	F. SP.	85mm	0.9594	32.1 - 33.6mm	7.7 ± 0.4	0.71 ± 0.03	10.1 ± 0.5
Camel Lights	F. SP.	100mm	1.1467	33.6 - 37.6mm	11.6 ± 0.4	0.86 ± 0.05	14.5 ± 0.5
Carlton	F. HP.	85mm	0.8161	36.8 - 40.0mm	**	**	**
Carlton	F. SP.	85mm	0.8172	32.0 - 35.0mm	**	0.11 ± 0.01	1.3 ± 0.1
Carlton	F. M. SP.	85mm	0.7916	31.9 - 34.2mm	**	0.08 ± 0.01	0.8 ± 0.1
Carlton 100's	F. HP.	100mm	1.0042	36.3 - 39.2mm	**	0.08 ± 0.01	0.6 ± 0.1
Carlton 100's	F. SP.	100mm	0.9357	33.4 - 37.3mm	3.6 ± 0.4	0.37 ± 0.02	5.6 ± 0.3
Carlton 100's	F. M. SP.	100mm	0.9306	33.3 - 36.5mm	3.1 ± 0.3	0.34 ± 0.02	4.4 ± 0.4
Chesterfield	Reg. NF. SP.	70mm	0.8647	23mm	20.6 ± 0.5	1.32 ± 0.03	13.2 ± 0.5
Chesterfield	NF. SP.	85mm	1.0443	23mm	24.8 ± 0.9	1.66 ± 0.04	16.1 ± 0.6
Chesterfield	F. SP.	85mm	0.9023	27.6 - 29.0mm	14.7 ± 0.4	1.04 ± 0.03	15.1 ± 0.4
Chesterfield 101	F. SP.	101mm	1.0558	34.2 - 38.2mm	15.3 ± 0.6	1.11 ± 0.06	16.3 ± 0.6
Decade	F. SP.	85mm	0.8530	33.1 - 34.1mm	4.6 ± 0.3	0.44 ± 0.01	4.4 ± 0.2
Decade	F. M. SP.	85mm	0.8598	31.8 - 33.9mm	4.6 ± 0.2	0.44 ± 0.02	4.2 ± 0.3
Decade 100's	F. SP.	100mm	0.9571	37.4 - 38.8mm	8.3 ± 0.3	0.82 ± 0.01	7.3 ± 0.2
Doral II	F. SP.	85mm	1.0752	35.5 - 37.4mm	3.6 ± 0.3	0.38 ± 0.02	3.2 ± 0.2
Doral II	F. M. SP.	85mm	1.0438	33.7 - 37.5mm	3.8 ± 0.3	0.41 ± 0.03	3.5 ± 0.3

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1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 F-filter; NF-non-filter; M-menthol; HP-hard pack; SP-soft pack; mm-millimeter.
4 Average weight reported in grams.
5 Range used in butt length because of variance of overwrap.
* Tolerance shown is twice the standard deviation.
** Below the sensitivity of the method.

TAR(1), NICOTINE(2) AND CARBON MONOXIDE OF TWO-HUNDRED (200) DOMESTIC CIGARETTES

BRAND	TYPE(3)		AVERAGE WEIGHT(4)	BUTT LENGTH(5)	TPM DRY(1)*	NICOTINE*	CARBON MONOXIDE
DuMaurier	F. HP.	85mm	0.9880	28.1 - 29.5mm	15.4 ± 0.5	1.04 ± 0.03	17.0 ± 0.5
English Ovals	Reg. NF. HP.	70mm	0.9363	23mm	22.7 ± 0.7	1.66 ± 0.04	11.9 ± 0.4
English Ovals	NF. HP.	85mm	1.1481	23mm	28.2 ± 1.0	2.14 ± 0.11	14.5 ± 0.6
Eve 100's	F. SP.	100mm	1.0201	34.2 - 38.1mm	14.9 ± 0.5	1.16 ± 0.03	14.4 ± 0.4
Eve 100's	F. M. SP.	100mm	1.0457	33.6 - 35.9mm	14.8 ± 0.4	1.17 ± 0.02	14.5 ± 0.4
Eve Lights 120's	F. HP.	120mm	0.9942	36.6 - 38.8mm	14.0 ± 0.6	1.14 ± 0.03	12.6 ± 0.9
Eve Lights 120's	F. M. HP.	120mm	1.0005	36.8 - 38.9mm	13.7 ± 0.5	1.11 ± 0.03	12.3 ± 0.5
Galaxy	F. SP.	85mm	1.0681	32.4 - 33.2mm	14.2 ± 0.5	0.95 ± 0.02	13.4 ± 1.3
Golden Lights	F. SP.	85mm	0.8998	33.2 - 35.7mm	7.3 ± 0.3	0.71 ± 0.03	8.1 ± 0.5
Golden Lights	F. M. SP.	85mm	0.8827	33.7 - 35.8mm	7.7 ± 0.4	0.71 ± 0.03	8.0 ± 0.5
Golden Lights 100's	F. SP.	100mm	1.0318	36.5 - 38.8mm	8.4 ± 0.5	0.81 ± 0.04	8.9 ± 0.6
Golden Lights 100's	F. M. SP.	100mm	1.0405	36.2 - 39.1mm	7.1 ± 0.5	0.71 ± 0.04	6.9 ± 0.6
Half & Half	F. SP.	85mm	1.1174	26.1 - 28.4mm	16.2 ± 0.6	1.33 ± 0.05	14.6 ± 0.5
Herbert Tareyton	NF. SP.	85mm	1.1630	23mm	27.2 ± 0.7	1.75 ± 0.04	19.4 ± 0.6
Hi-Lite 100's	F. HP.	100mm	1.1103	33.6 - 34.7mm	12.3 ± 0.4	0.89 ± 0.02	13.1 ± 0.5
Iceberg 100's	F. M. SP.	100mm	0.9585	33.4 - 38.0mm	2.3 ± 0.3	0.26 ± 0.02	3.6 ± 0.2
Kent	F. HP.	80mm	0.8981	27.1 - 29.0mm	12.4 ± 0.5	0.97 ± 0.03	12.2 ± 0.4
Kent	F. SP.	85mm	0.9302	26.1 - 29.6mm	12.5 ± 0.5	1.00 ± 0.03	12.6 ± 0.5
Kent III	F. SP.	85mm	0.8401	33.6 - 36.0mm	2.3 ± 0.2	0.32 ± 0.01	2.9 ± 0.2
Kent 100's	F. SP.	100mm	1.0632	33.4 - 36.6mm	14.4 ± 0.4	1.18 ± 0.05	13.5 ± 0.5
Kent 100's	F. M. SP.	100mm	1.0663	33.8 - 36.3mm	14.6 ± 0.3	1.25 ± 0.04	13.6 ± 0.6
Kent III 100's	F. SP.	100mm	0.9903	37.1 - 38.6mm	4.4 ± 0.3	0.50 ± 0.02	6.6 ± 0.3
Kool	Reg. NF. M. SP.	70mm	0.8469	23mm	19.2 ± 0.5	1.13 ± 0.05	14.4 ± 0.3
Kool	F. M. HP.	80mm	0.9406	24.1 - 27.3mm	16.3 ± 0.4	1.24 ± 0.03	16.3 ± 0.3
Kool	F. M. SP.	85mm	0.9483	28.4 - 29.6mm	15.6 ± 0.3	1.15 ± 0.02	16.5 ± 0.4
Kool Milds	F. M. SP.	85mm	0.9311	32.4 - 33.2mm	11.0 ± 0.2	0.87 ± 0.02	12.3 ± 0.4
Kool Super Lights	F. M. SP.	85mm	0.9282	31.2 - 33.9mm	6.1 ± 0.3	0.53 ± 0.02	6.9 ± 0.3
Kool Super Longs 100's	F. M. SP.	100mm	1.0894	34.4 - 35.9mm	14.2 ± 0.3	1.04 ± 0.02	16.0 ± 0.6
Kool Milds 100's	F. M. SP.	100mm	1.1530	37.9 - 40.0mm	12.0 ± 0.3	0.99 ± 0.03	12.8 ± 0.3
Kool Super Lights 100's	F. M. SP.	100mm	1.1438	37.5 - 40.3mm	9.5 ± 0.5	0.72 ± 0.02	12.1 ± 0.5
L & M	F. HP.	80mm	0.8690	26.2 - 27.6mm	14.6 ± 0.4	1.01 ± 0.04	14.5 ± 0.3
L & M	F. SP.	85mm	0.8993	28.0 - 29.5mm	14.5 ± 0.5	1.00 ± 0.05	14.8 ± 0.5
L & M Lights	F. SP.	85mm	0.8533	32.0 - 33.6mm	7.8 ± 0.3	0.75 ± 0.02	6.5 ± 0.3
L & M 100's	F. SP.	100mm	1.0405	34.3 - 38.4mm	14.8 ± 0.5	1.08 ± 0.04	15.6 ± 0.7
L & M Lights 100's	F. SP.	100mm	0.9651	36.2 - 38.8mm	7.3 ± 0.3	0.74 ± 0.03	5.6 ± 0.2
L & M Lights 100's	F. M. SP.	100mm	0.9544	36.6 - 38.4mm	7.4 ± 0.3	0.77 ± 0.04	5.7 ± 0.2
Lark	F. SP.	85mm	1.0083	26.4 - 28.3mm	14.4 ± 0.5	1.10 ± 0.03	14.0 ± 0.5
Lark Lights	F. SP.	85mm	0.8157	32.1 - 33.6mm	7.2 ± 0.3	0.61 ± 0.01	7.4 ± 0.2
Lark 100's	F. SP.	100mm	1.1471	32.0 - 34.0mm	15.8 ± 0.5	1.21 ± 0.03	15.0 ± 0.5
Lark Lights 100's	F. SP.	100mm	0.9723	37.4 - 38.5mm	7.0 ± 0.5	0.61 ± 0.02	7.1 ± 0.4
Long Johns 120's	F. SP.	120mm	1.2306	37.0 - 39.0mm	17.6 ± 0.8	1.40 ± 0.06	18.5 ± 0.8
Long Johns 120's	F. M. SP.	120mm	1.1790	36.4 - 39.1mm	15.5 ± 0.8	1.34 ± 0.06	16.7 ± 1.0
Lucky Strike	Reg. NF. SP.	70mm	0.9324	23mm	24.0 ± 0.6	1.46 ± 0.04	17.0 ± 0.7
Lucky Ten	F. SP.	85mm	0.9907	31.2 - 34.4mm	7.6 ± 0.4	0.63 ± 0.03	9.3 ± 0.5

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1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 F-filter; NF-non-filter; M-menthol; HP-hard pack; SP-soft pack; mm-millimeter.
4 Average weight reported in grams.
5 Range used in butt length because of variance of overwrap.
* Tolerance shown is twice the standard deviation.
** Below the sensitivity of the method.

TAR(1), NICOTINE(2) AND CARBON MONOXIDE OF TWO-HUNDRED (200) DOMESTIC CIGARETTES

BRAND	TYPE(3)		AVERAGE WEIGHT(4)	BUTT LENGTH(5)	TPM DRY(1)*	NICOTINE*	CARBON MONOXIDE
Lucky 100's	F. SP.	100mm	0.9533	33.5 - 35.7mm	3.0 ± 0.3	0.33 ± 0.04	4.5 ± 0.3
Marlboro	F. HP.	80mm	0.9345	25.0 - 26.2mm	16.0 ± 0.5	1.04 ± 0.02	14.5 ± 0.5
Marlboro	F. M. HP.	80mm	0.9171	25.4 - 26.0mm	14.5 ± 0.5	0.90 ± 0.03	13.7 ± 0.4
Marlboro	F. SP.	85mm	0.9894	26.6 - 28.7mm	16.5 ± 0.5	1.05 ± 0.03	15.2 ± 0.5
Marlboro	F. M. SP.	85mm	0.9789	28.0 - 29.2mm	13.7 ± 0.4	0.87 ± 0.02	13.5 ± 0.4
Marlboro Lights	F. HP.	85mm	0.9738	32.5 - 35.0mm	10.3 ± 0.3	0.73 ± 0.03	11.9 ± 0.4
Marlboro Lights	F. SP.	85mm	0.9912	32.9 - 34.9mm	10.7 ± 0.3	0.75 ± 0.02	12.4 ± 0.6
Marlboro 100's	F. HP.	100mm	1.1235	33.0 - 35.0mm	16.1 ± 0.4	1.07 ± 0.03	16.0 ± 0.4
Marlboro 100's	F. SP.	100mm	1.1436	33.8 - 35.4mm	16.3 ± 0.5	1.08 ± 0.03	16.2 ± 0.5
Marlboro Lights 100's	F. SP.	100mm	1.1368	38.4 - 39.5mm	10.2 ± 0.4	0.74 ± 0.02	12.4 ± 0.5
Max 120's	F. SP.	120mm	1.0228	36.1 - 38.8mm	18.7 ± 0.4	1.56 ± 0.05	17.6 ± 0.4
Max 120's	F. M. SP.	120mm	1.0013	36.6 - 40.1mm	18.9 ± 0.3	1.57 ± 0.06	17.8 ± 0.5
Merit	F. SP.	85mm	0.9822	34.4 - 36.1mm	7.0 ± 0.5	0.51 ± 0.02	10.4 ± 0.6
Merit	F. M. SP.	85mm	0.9841	33.6 - 36.0mm	6.9 ± 0.3	0.51 ± 0.01	9.7 ± 0.4
Merit Ultra Lights	F. SP.	85mm	0.9197	34.5 - 35.7mm	2.9 ± 0.3	0.32 ± 0.02	3.8 ± 0.1
Merit Ultra Lights	F. M. SP.	85mm	0.9188	34.5 - 35.9mm	3.0 ± 0.2	0.29 ± 0.01	3.6 ± 0.2
Merit 100's	F. SP.	100mm	1.1230	38.0 - 39.9mm	9.6 ± 0.4	0.70 ± 0.03	12.2 ± 0.5
Merit 100's	F. M. SP.	100mm	1.1269	37.8 - 40.9mm	9.1 ± 0.4	0.68 ± 0.02	11.5 ± 0.5
Montclair	F. M. SP.	85mm	0.9139	26.2 - 27.9mm	14.4 ± 0.4	1.00 ± 0.03	15.9 ± 0.4
More 120's	F. SP.	120mm	1.0423	33.2 - 42.7mm	18.1 ± 0.9	1.44 ± 0.06	20.4 ± 0.8
More 120's	F. M. SP.	120mm	1.0510	36.1 - 42.4mm	18.4 ± 0.8	1.52 ± 0.05	19.7 ± 1.1
Multifilter	F. SP.	85mm	1.1542	32.4 - 33.8mm	12.0 ± 0.3	0.83 ± 0.02	11.3 ± 0.4
Multifilter	F. M. SP.	85mm	1.1343	31.9 - 33.6mm	11.6 ± 0.4	0.80 ± 0.02	10.7 ± 0.3
Newport	F. M. HP.	80mm	0.8758	27.6 - 28.8mm	15.7 ± 0.5	1.22 ± 0.03	16.1 ± 0.4
Newport	F. M. SP.	85mm	0.9284	27.0 - 29.2mm	17.5 ± 0.4	1.34 ± 0.03	18.0 ± 0.7
Newport Lights	F. M. HP.	80mm	0.8458	32.0 - 34.1mm	8.2 ± 0.4	0.73 ± 0.03	9.8 ± 0.5
Newport Lights	F. M. SP.	85mm	0.8810	34.4 - 35.3mm	8.2 ± 0.4	0.78 ± 0.03	9.6 ± 0.6
Newport 100's	F. M. SP.	100mm	1.0615	33.2 - 37.4mm	19.8 ± 0.4	1.57 ± 0.04	19.6 ± 0.6
Now	F. HP.	80mm	0.7082	32.2 - 35.4mm	**	0.05 ± 0.01	**
Now	F. SP.	85mm	0.8301	32.0 - 33.6mm	1.7 ± 0.1	0.22 ± 0.01	2.8 ± 0.2
Now	F. M. SP.	85mm	0.8249	32.2 - 33.7mm	1.5 ± 0.3	0.20 ± 0.01	2.5 ± 0.2
Now 100's	F. HP.	100mm	0.6888	36.5 - 38.6mm	**	**	**
Now 100's	F. SP.	100mm	0.9686	36.6 - 38.0mm	1.1 ± 0.2	0.19 ± 0.02	1.2 ± 0.1
Now 100's	F. M. SP.	100mm	1.0041	36.2 - 39.0mm	1.2 ± 0.2	0.21 ± 0.02	1.3 ± 0.2
Oasis	F. M. SP.	85mm	0.9081	27.0 - 28.5mm	14.9 ± 0.3	1.03 ± 0.03	14.9 ± 0.3
Old Gold Straight	NF. SP.	85mm	1.0076	23mm	26.4 ± 0.7	1.79 ± 0.04	17.1 ± 0.5
Old Gold Filters	F. SP.	85mm	0.9329	27.3 - 31.8mm	17.0 ± 0.5	1.34 ± 0.03	18.7 ± 0.6
Old Gold Lights	F. SP.	85mm	0.8941	33.4 - 37.7mm	9.6 ± 0.3	0.92 ± 0.02	10.5 ± 0.4
Old Gold Filter 100's	F. SP.	100mm	1.0605	33.1 - 37.1mm	19.7 ± 0.5	1.55 ± 0.04	20.3 ± 0.6
Pall Mall	NF. SP.	85mm	1.0857	23mm	24.3 ± 0.4	1.52 ± 0.03	16.7 ± 0.6
Pall Mall	F. SP.	85mm	1.0058	25.2 - 28.0mm	17.6 ± 0.4	1.21 ± 0.03	18.1 ± 0.3
Pall Mall Extra Light	F. SP.	85mm	0.9934	31.1 - 35.0mm	6.0 ± 0.3	0.54 ± 0.04	6.4 ± 0.4
Pall Mall 100's	F. SP.	100mm	1.1572	34.2 - 35.4mm	16.6 ± 0.6	1.30 ± 0.05	17.2 ± 0.8
Pall Mall Light 100's	F. SP.	100mm	1.1104	36.6 - 38.9mm	9.2 ± 0.4	0.83 ± 0.03	8.7 ± 0.4

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 F-filter; NF-non-filter; M-menthol; HP-hard pack; SP-soft pack; mm-millimeter.
4 Average weight reported in grams.
5 Range used in butt length because of variance of overwrap.
* Tolerance shown is twice the standard deviation.
** Below the sensitivity of the method.
6 See statement in text concerning Barclay.

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TAR(1), NICOTINE(2) AND CARBON MONOXIDE OF TWO-HUNDRED (200) DOMESTIC CIGARETTES

BRAND	TYPE(3)		AVERAGE WEIGHT(4)	BUTT LENGTH(5)	TPM DRY(1)*	NICOTINE*	CARBON MONOXIDE
Pall Mall Light 100's	F. M. SP.	100mm	1.0391	34.0 - 36.0mm	12.5 ± 0.3	1.05 ± 0.03	12.0 ± 0.4
Parliament Lights	F. HP.	80mm	0.9682	31.7 - 34.2mm	9.0 ± 0.3	0.64 ± 0.02	10.3 ± 0.3
Parliament Lights	F. SP.	85mm	1.0072	31.8 - 33.0mm	8.9 ± 0.4	0.64 ± 0.02	10.2 ± 0.4
Parliament Lights 100's	F. SP.	100mm	1.2520	38.0 - 41.0mm	11.8 ± 0.4	0.87 ± 0.02	11.2 ± 0.4
Philip Morris	Reg. NF. SP.	70mm	0.8992	23mm	21.3 ± 0.7	1.41 ± 0.04	12.3 ± 0.5
Philip Morris Commander	NF. SP.	85mm	1.0706	23mm	26.6 ± 0.5	1.72 ± 0.03	15.2 ± 0.6
Philip Morris International 100's	F. HP.	100mm	1.1244	34.4 - 35.3mm	16.5 ± 0.4	1.08 ± 0.02	15.7 ± 0.4
Philip Morris International 100's	F. M. HP.	100mm	1.1140	34.0 - 35.4mm	16.2 ± 0.4	1.02 ± 0.03	15.1 ± 0.6
Picayune	Reg. NF. SP.	70mm	0.8751	23mm	19.3 ± 0.8	1.38 ± 0.05	15.0 ± 1.0
Players	Reg. NF. HP.	70mm	1.0526	23mm	24.1 ± 0.4	1.93 ± 0.05	14.1 ± 0.4
Raleigh	NF. SP.	85mm	1.0543	23mm	22.5 ± 0.5	1.33 ± 0.03	16.9 ± 0.6
Raleigh	F. SP.	85mm	0.9814	27.6 - 30.0mm	15.4 ± 0.4	1.01 ± 0.03	17.2 ± 0.5
Raleigh Lights	F. SP.	85mm	0.9843	31.7 - 33.6mm	8.3 ± 0.3	0.72 ± 0.02	10.6 ± 0.4
Raleigh 100's	F. SP.	100mm	1.1471	33.2 - 35.6mm	15.6 ± 0.5	1.11 ± 0.04	16.7 ± 0.6
Raleigh Lights 100's	F. SP.	100mm	1.1083	37.6 - 39.7mm	9.4 ± 0.4	0.78 ± 0.04	12.7 ± 0.6
St. Moritz 100's	F. SP.	100mm	1.0602	35.3 - 37.6mm	13.5 ± 0.5	1.07 ± 0.04	13.4 ± 0.4
St. Moritz 100's	F. M. SP.	100mm	1.0568	35.0 - 37.6mm	14.4 ± 0.4	1.11 ± 0.03	14.3 ± 0.4
Salem	F. M. SP.	85mm	0.9976	27.0 - 28.9mm	14.1 ± 0.5	1.06 ± 0.03	13.6 ± 0.4
Salem Lights	F. M. SP.	85mm	0.9672	32.4 - 34.6mm	7.8 ± 0.4	0.60 ± 0.04	9.6 ± 0.4
Salem Ultra	F. M. SP.	85mm	0.9358	31.9 - 33.5mm	3.3 ± 0.1	0.38 ± 0.05	3.8 ± 0.3
Salem 100's	F. M. SP.	100mm	1.1663	33.4 - 35.6mm	14.6 ± 0.3	1.15 ± 0.04	13.6 ± 0.4
Salem Lights 100's	F. M. SP.	100mm	1.1540	34.3 - 38.0mm	9.3 ± 0.3	0.78 ± 0.03	11.2 ± 0.4
Salem Ultra 100's	F. M. SP.	100mm	1.1224	36.5 - 38.0mm	3.9 ± 0.2	0.41 ± 0.02	5.3 ± 0.2
Saratoga 120's	F. HP.	120mm	1.1080	36.1 - 39.9mm	14.9 ± 0.5	1.03 ± 0.03	16.0 ± 0.6
Saratoga 120's	F. M. HP.	120mm	1.1163	37.4 - 39.0mm	14.8 ± 0.5	1.03 ± 0.03	15.6 ± 0.6
Silva Thins 100's	F. SP.	100mm	0.9769	33.5 - 36.0mm	11.4 ± 0.4	1.04 ± 0.03	9.3 ± 0.3
Silva Thins 100's	F. M. SP.	100mm	0.9879	34.1 - 35.6mm	11.1 ± 0.4	1.02 ± 0.04	9.2 ± 0.4
Spring 100's	F. M. SP.	100mm	1.1027	32.7 - 35.8mm	19.2 ± 0.4	1.13 ± 0.03	17.6 ± 0.5
Tall 120's	F. SP.	120mm	1.2184	35.2 - 39.4mm	17.4 ± 0.6	1.41 ± 0.04	18.6 ± 0.8
Tall 120's	F. M. SP.	120mm	1.2130	36.2 - 39.5mm	16.4 ± 0.6	1.36 ± 0.04	17.1 ± 0.6
Tareyton	F. SP.	85mm	1.0373	25.9 - 28.1mm	14.2 ± 0.5	0.99 ± 0.03	15.3 ± 0.5
Tareyton Lights	F. SP.	85mm	0.9202	32.0 - 37.5mm	4.8 ± 0.4	0.43 ± 0.02	5.3 ± 0.4
Tareyton Ultra Low Tar	F. M. SP.	85mm	0.8999	33.4 - 36.8mm	0.5 ± 0.2	0.13 ± 0.02	0.8 ± 0.1
Tareyton 100's	F. SP.	100mm	1.1827	33.5 - 36.0mm	14.2 ± 0.5	1.05 ± 0.03	16.2 ± 0.6
Tareyton Long Lights 100's	F. SP.	100mm	1.1988	32.6 - 36.7mm	7.0 ± 0.4	0.63 ± 0.02	7.1 ± 0.3
Triumph	F. SP.	85mm	0.8404	34.6 - 35.8mm	2.7 ± 0.3	0.37 ± 0.01	3.0 ± 0.2
Triumph	F. M. SP.	85mm	0.8470	33.7 - 35.9mm	2.2 ± 0.3	0.33 ± 0.02	2.5 ± 0.2
Triumph 100's	F. SP.	100mm	0.9888	36.8 - 38.4mm	4.2 ± 0.2	0.50 ± 0.02	6.0 ± 0.3
Triumph 100's	F. M. SP.	100mm	1.0116	36.9 - 38.7mm	3.8 ± 0.3	0.49 ± 0.05	5.3 ± 0.3
True	F. SP.	85mm	0.8425	32.0 - 33.6mm	4.3 ± 0.3	0.43 ± 0.02	4.9 ± 0.2
True	F. M. SP.	85mm	0.8539	31.9 - 34.3mm	4.4 ± 0.3	0.42 ± 0.03	5.1 ± 0.3
True Ultra One	F. SP.	85mm	0.8565	34.2 - 35.1mm	0.7 ± 0.2	0.18 ± 0.01	1.1 ± 0.1
True 100's	F. SP.	100mm	1.0197	34.1 - 35.6mm	7.3 ± 0.3	0.64 ± 0.02	8.7 ± 0.4
True 100's	F. M. SP.	100mm	0.9898	34.4 - 36.2mm	7.8 ± 0.4	0.63 ± 0.04	9.1 ± 0.4

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1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 F-filter; NF-non-filter; M-menthol; HP-hard pack; SP-soft pack; mm-millimeter.
4 Average weight reported in grams.
5 Range used in butt length because of variance of overwrap.
* Tolerance shown is twice the standard deviation.
** Below the sensitivity of the method.
[illegible] in text concerning Barclay.

TAR(1), NICOTINE(2) AND CARBON MONOXIDE . . TWO-HUNDRED (200) DOMESTIC CIGARETTES

BRAND	TYPE(3)		AVERAGE WEIGHT(4)	BUTT LENGTH(5)	TPM DRY(1)*	NICOTINE	CARBON MONOXIDE
Vantage	F. SP.	85mm	1.0704	30.7 - 35.4mm	9.0 ± 0.3	0.71 ± 0.02	12.5 ± 0.3
Vantage	F. M. SP.	85mm	1.1119	31.9 - 33.0mm	9.9 ± 0.3	0.73 ± 0.02	14.3 ± 0.4
Vantage Ultra Lights	F. SP.	85mm	1.0063	30.4 - 33.9mm	6.3 ± 0.2	0.54 ± 0.02	9.0 ± 0.3
Vantage 100's	F. SP.	100mm	1.2653	33.4 - 37.0mm	8.3 ± 0.5	0.68 ± 0.02	12.2 ± 0.5
Vantage Ultra Lights 100's	F. SP.	100mm	1.2488	35.5 - 38.4mm	5.1 ± 0.3	0.47 ± 0.02	7.9 ± 0.5
Viceroy	F. SP.	85mm	0.9453	27.9 - 30.9mm	14.6 ± 0.5	0.97 ± 0.04	16.0 ± 0.4
Viceroy Rich Lights	F. SP.	85mm	0.9956	32.0 - 34.5mm	7.9 ± 0.4	0.69 ± 0.03	9.8 ± 0.5
Viceroy Super Long 100's	F. SP.	100mm	1.1316	33.4 - 35.6mm	14.8 ± 0.5	1.09 ± 0.03	16.3 ± 0.7
Viceroy Rich Lights 100's	F. SP.	100mm	1.1537	37.4 - 40.6mm	9.1 ± 0.3	0.77 ± 0.03	11.6 ± 0.5
Virginia Slims 100's	F. SP.	100mm	0.9584	33.8 - 36.0mm	15.1 ± 0.4	1.00 ± 0.02	15.1 ± 0.5
Virginia Slims 100's	F. M. SP.	100mm	0.9632	33.6 - 35.7mm	15.1 ± 0.4	1.00 ± 0.02	14.2 ± 0.5
Virginia Slims Lights 100's	F. HP.	100mm	0.9514	38.1 - 40.0mm	7.5 ± 0.3	0.58 ± 0.01	8.3 ± 0.4
Virginia Slims Lights 100's	F. M. HP.	100mm	0.9949	37.5 - 40.3mm	7.4 ± 0.3	0.58 ± 0.02	8.0 ± 0.2
Winston	F. HP.	80mm	0.9508	24.8 - 26.4mm	16.1 ± 0.4	1.11 ± 0.03	15.0 ± 0.5
Winston	F. SP.	85mm	0.9831	26.9 - 28.6mm	15.4 ± 0.5	1.10 ± 0.03	15.5 ± 0.5
Winston Lights	F. SP.	85mm	0.9955	29.8 - 35.6mm	10.8 ± 0.6	0.85 ± 0.03	11.8 ± 0.4
Winston Ultra	F. SP.	85mm	0.8272	32.2 - 35.9mm	3.6 ± 0.2	0.41 ± 0.03	4.9 ± 0.4
Winston 100's	F. SP.	100mm	1.1427	33.1 - 35.6mm	13.7 ± 0.3	1.02 ± 0.03	14.3 ± 0.4
Winston Lights 100's	F. SP.	100mm	1.1289	36.2 - 37.6mm	11.6 ± 0.4	0.89 ± 0.03	14.4 ± 0.5
Winston Ultra 100's	F. SP.	100mm	1.0698	36.8 - 37.8mm	4.7 ± 0.5	0.46 ± 0.03	7.1 ± 0.7
Winston International 100's	F. HP.	100mm	1.0756	31.0 - 32.2mm	17.9 ± 0.5	1.41 ± 0.04	16.3 ± 0.6
Additional Cigarettes Smoked Separately							
Carlton 100's	F. M. HP.	100mm	0.9108	37.6 - 38.5mm	**	0.12 ± 0.01	0.8 ± 0.1
Carlton 120's	F. SP.	120mm	0.9624	37.0 - 38.6mm	6.2 ± 0.3	0.62 ± 0.02	5.9 ± 0.3
Carlton 120's	F. M. SP.	120mm	1.0391	37.2 - 39.3mm	5.0 ± 0.3	0.53 ± 0.02	4.9 ± 0.3

2021574846

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 F-filter; NF-non-filter; M-menthol; HP-hard pack; SP-soft pack; mm-millimeter.
4 Average weight reported in grams.
5 Range used in butt length because of variance of overwrap.
* Tolerance shown is twice the standard deviation.
** Below the sensitivity of the method.

Tar[1], Nicotine and Carbon Monoxide Content of [illegible]
Varieties of Domestic Cigarettes
(shown in increasing order of tar values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Benson & Hedges 2/	reg. size, filter, (hard pack)	<0.5	0.1	1
Cambridge 2/	king size, filter, (hard pack)	<0.5	<0.05	<0.5
Cambridge 2/	king size, filter	<0.5	0.1	1
Carlton 2/	king size, filter, (hard pack)	<0.5	<0.05	<0.5
Carlton 2/	king size, filter	<0.5	0.1	1
Carlton 2/	king size, filter, menthol	<0.5	0.1	1
Carlton 100's 2/	100mm, filter, (hard pack)	<0.5	0.1	1
Carlton 100's 2/	100mm, filter, menthol, (hard pack)	<0.5	0.1	1
Now 2/	king size, filter, (hard pack)	<0.5	0.1	<0.5
Now 100's 2/	100mm, filter, (hard pack)	<0.5	<0.05	<0.5
Tareyton Ultra Low Tar	king size, filter, menthol	1	0.1	1
Barclay 3/	king size, filter, (hard pack)	1	0.1	1
True Ultra One	king size, filter	1	0.2	1
Barclay 3/	king size, filter.	1	0.2	1
Now 100's	100mm, filter	1	0.2	1
Now 100's	100mm, filter, menthol	1	0.2	1
Now	king size, filter, menthol	2	0.2	3
Now	king size, filter	2	0.2	3
Barclay 100's 3/	100mm, filter	2	0.3	2
Triumph	king size, filter, menthol	2	0.3	3
Kent III	king size, filter	2	0.3	3
Iceberg 100's	100mm, filter, menthol	2	0.3	4
Triumph	king size, filter	3	0.4	3
Merit Ultra Lights	king size, filter	3	0.3	4
Cambridge 100's	100mm, filter	3	0.3	5
Merit Ultra Lights	king size, filter, menthol	3	0.3	4
Lucky 100's	100mm, filter	3	0.3	4
Carlton 100's	100mm, filter, menthol	3	0.3	4
Salem Ultra	king size, filter, menthol	3	0.4	4
Doral II	king size, filter	4	0.4	3
Carlton 100's	100mm, filter	4	0.4	6
Winston Ultra	king size, filter	4	0.4	5
Triumph 100's	100mm, filter, menthol	4	0.5	5
Doral II	king size, filter, menthol	4	0.4	3
Salem Ultra 100's	100mm, filter, menthol	4	0.4	5
Triumph 100's	100mm, filter	4	0.5	6
True	king size, filter	4	0.4	5
True	king size, filter, menthol	4	0.4	5
Kent III 100's	100mm, filter	4	0.5	7
Decade	king size, filter, menthol	5	0.4	6
Decade	king size, filter	5	0.4	6
Winston Ultra 100's	100mm filter	5	0.5	7
Tareyton Lights	king size, filter	5	0.4	5
Carlton 120's	120mm, filter, menthol	5	0.5	5

2021574847

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.
3 See statement in text concerning Barclay.

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200)
Varieties of Domestic Cigarettes
(shown in increasing order of tar values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Vantage Ultra Lights 100's	100mm, filter	5	0.5	8
Pall Mall Extra Light	king size, filter	6	0.5	6
Kool Super Lights	king size, filter, menthol	6	0.5	7
Carlton 120's	120mm, filter	6	0.6	6
Vantage Ultra Lights	king size, filter	6	0.5	9
Camel Lights	king size, filter, (hard pack)	6	0.6	7
Merit	king size, filter, menthol	7	0.5	10
Tareyton Long Lights 100's	100mm, filter	7	0.6	7
Merit	king size, filter	7	0.5	10
Lark Lights 100's	100mm, filter	7	0.6	7
Golden Lights 100's	100mm, filter, menthol	7	0.7	7
Lark Lights	king size, filter	7	0.6	7
L & M Lights 100's	100mm, filter	7	0.7	6
True 100's	100mm, filter	7	0.6	9
Golden Lights	king size, filter	7	0.7	8
Virginia Slims Lights 100's	100mm, filter, menthol, (hard pack)	7	0.6	8
Arctic Lights 100's	100mm, filter, menthol	7	0.6	9
L & M Lights 100's	100mm, filter, menthol	7	0.8	6
Virginia Slims Lights 100's	100mm, filter, (hard pack)	7	0.6	8
American Lights 120's	120mm, filter, menthol	8	0.7	8
Arctic Lights	king size, filter, menthol	8	0.6	9
Lucky Ten	king size, filter	8	0.6	9
Golden Lights	king size, filter, menthol	8	0.7	8
Camel Lights	king size, filter	8	0.7	10
American Lights 120's	120mm, filter	8	0.7	9
L & M Lights	king size, filter	8	0.7	7
Salem Lights	king size, filter, menthol	8	0.6	10
True 100's	100mm, filter, menthol	8	0.6	9
Viceroy Rich Lights	king size, filter	8	0.7	10
Belair	king size, filter, menthol	8	0.7	9
Newport Lights	king size, filter, menthol, (hard pack)	8	0.7	10
Newport Lights	king size, filter, menthol	8	0.8	10
Vantage 100's	100mm, filter	8	0.7	12
Decade 100's	100mm, filter	8	0.8	7
Raleigh Lights	king size, filter	8	0.7	11
Golden Lights 100's	100mm, filter	8	0.8	9
Belair 100's	100mm, filter, menthol	8	0.6	10
Parliament Lights	king size, filter	9	0.6	10
Parliament Lights	king size, filter, (hard pack)	9	0.6	10
Vantage	king size, filter	9	0.7	13
Merit 100's	100mm, filter, menthol	9	0.7	11
Viceroy Rich Lights 100's	100mm, filter	9	0.8	12
Pall Mall Light 100's	100mm, filter	9	0.8	9
Salem Lights 100's	100mm, filter, menthol	9	0.8	11

2021574848

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.
3 See statement in text concerning Barclay.

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200)
Varieties of Domestic Cigarettes
(shown in increasing order of tar values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Raleigh Lights 100's	100mm, filter	9	0.8	13
Kool Super Lights 100's	100mm, filter, menthol	9	0.7	12
Old Gold Lights	king size, filter	10	0.9	10
Merit 100's	100mm, filter	10	0.7	12
Benson & Hedges Lights 100's	100mm, filter, menthol, (hard pack)	10	0.7	11
Vantage	king size, filter, menthol	10	0.7	14
Benson & Hedges Lights 100's	100mm, filter, menthol	10	0.7	12
Marlboro Lights 100's	100mm, filter	10	0.7	12
Marlboro Lights	king size, filter, (hard pack)	10	0.7	12
Benson & Hedges Lights 100's	100mm, filter	10	0.7	13
Benson & Hedges Lights 100's	100mm, filter, (hard pack)	11	0.7	11
Marlboro Lights	king size, filter	11	0.7	12
Winston Lights	king size, filter	11	0.9	11
Kool Milds	king size, filter, menthol	11	0.9	12
Silva Thins 100's	100mm, filter, menthol	11	1.0	9
Silva Thins 100's	100mm, filter	11	1.0	9
Camel Lights 100's	100mm, filter	12	0.9	15
Multifilter	king size, filter, menthol	12	0.8	11
Winston Lights 100's	100mm, filter	12	0.9	14
Parliament Lights 100's	100mm, filter	12	0.9	11
Kool Milds 100's	100mm, filter, menthol	12	1.0	13
Multifilter	king size, filter	12	0.8	11
Hi-Lite 100's	100mm, filter, (hard pack)	12	0.9	13
Kent	king size, filter, (hard pack)	12	1.0	12
Pall Mall Light 100's	100mm, filter, menthol	12	1.1	12
Kent	king size, filter	13	1.0	13
St. Moritz 100's	100mm, filter	14	1.1	13
Winston 100's	100mm, filter	14	1.0	14
Marlboro	king size, filter, menthol	14	0.9	14
Eve Lights 120's	120mm, filter, menthol, (hard pack)	14	1.1	12
Alpine	king size, filter, menthol	14	0.9	13
Eve Lights 120's	120mm, filter, (hard pack)	14	1.1	13
Salem	king size, filter, menthol	14	1.1	14
Tareyton	king size, filter	14	1.0	15
Tareyton 100's	100mm, filter	14	1.1	16
Kool Super Longs 100's	100mm, filter, menthol	14	1.0	16
Galaxy	king size, filter	14	1.0	13
Kent 100's	100mm, filter	14	1.2	13
Montclair	king size, filter, menthol	14	1.0	16
St. Moritz 100's	100mm, filter, menthol	14	1.1	14
Lark	king size, filter	14	1.1	14
L & M	king size, filter	14	1.0	15
Marlboro	king size, filter, menthol, (hard pack)	15	0.9	14
Viceroy	king size, filter	15	1.0	16

2021574849

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.
3 See statement in text concerning Barclay.

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200) Varieties of Domestic Cigarettes
(shown in increasing order of tar values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Salem 100's	100mm, filter, menthol	15	1.1	14
Kent 100's	100mm, filter, menthol	15	1.2	14
L & M	king size, filter, (hard pack)	15	1.0	14
Chesterfield	king size, filter	15	1.0	15
Viceroy Super Longs 100's	100mm, filter	15	1.1	16
Saratoga 120's	120mm, filter, menthol, (hard pack)	15	1.0	16
Eve 100's	100mm, filter, menthol	15	1.2	14
L & M 100's	100mm, filter	15	1.1	16
Benson & Hedges	king size, filter, (hard pack)	15	1.2	12
Oasis	king size, filter, menthol	15	1.0	15
Eve 100's	100mm, filter	15	1.2	14
Saratoga 120's	102mm, filter, (hard pack)	15	1.0	16
Virginia Slims 100's	100mm, filter	15	1.0	15
Virginia Slims 100's	100mm, filter, menthol	15	1.0	14
Chesterfield 101	101mm, filter	15	1.1	16
DuMaurier	king size, filter, (hard pack)	15	1.0	17
Raleigh	king size, filter	15	1.0	17
Winston	king size, filter	15	1.1	16
Long Johns 120's	120mm, filter, menthol	16	1.3	17
Raleigh 100's	100mm, filter	16	1.1	17
Kool	king size, filter, menthol	16	1.1	17
Benson & Hedges 100's	100mm, filter, menthol, (hard pack)	16	1.0	15
Newport	king size, filter, menthol, (hard pack)	16	1.2	16
Lark 100's	100mm, filter	16	1.2	15
Benson & Hedges 100's	100mm, filter, menthol	16	1.1	17
Camel	king size, filter	16	1.2	16
Marlboro	king size, filter, (hard pack)	16	1.0	14
Benson & Hedges 100's	100mm, filter, (hard pack)	16	1.1	16
Winston	king size, filter, (hard pack)	16	1.1	15
Marlboro 100's	100mm, filter, (hard pack)	16	1.1	16
Philip Morris International 100's	100mm, filter, menthol, (hard pack)	16	1.0	13
Half & Half	king size, filter	16	1.3	15
Marlboro 100's	100mm, filter	16	1.1	16
Kool	king size, filter, menthol, (hard pack)	16	1.2	16
Tall 120's	120mm, filter, menthol	16	1.4	17
Benson & Hedges 100's	100mm, filter	16	1.1	16
Philip Morris International 100's	100mm, filter, (hard pack)	16	1.1	16
Marlboro	king size, filter	16	1.0	15
Pall Mall 100's	100mm, filter	17	1.3	17
Old Gold Filters	king size, filter	17	1.3	19
Tall 120's	120mm, filter	17	1.4	19
Newport	king size, filter, menthol	17	1.3	18
Pall Mall	king size, filter	18	1.2	18
Long Johns 120's	120mm, filter	18	1.4	18

2021574850

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as 0.5, 0.05, 0.5, respectively.
3 See statement in text concerning Barclay.

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200)
Varieties of Domestic Cigarettes
(shown in increasing order of tar values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Winston International 100's	100mm, filter	18	1.4	16
More 120's	120mm, filter	18	1.4	20
More 120's	120mm, filter, menthol	18	1.5	20
Max 120's	120mm, filter	19	1.6	18
Max 120's	120mm, filter, menthol	19	1.6	18
Spring 100's	100mm, filter, menthol	19	1.1	18
Kool	reg. size, non-filter, menthol	19	1.1	14
Picayune	reg. size, non-filter	19	1.4	15
Old Gold Filters	100mm, filter	20	1.5	20
Newport 100's	100mm, filter, menthol	20	1.6	20
Camel	reg. size, non-filter	21	1.4	13
Chesterfield	reg. size, non-filter	21	1.3	13
Philip Morris	reg. size, non-filter	21	1.4	12
Raleigh	king size, non-filter	22	1.3	17
English Ovals	reg. size, non-filter, (hard pack)	23	1.7	12
Lucky Strike	reg. size, non-filter	24	1.5	17
Players	reg. size, non-filter, (hard pack)	24	1.9	14
Pall Mall	king size, non-filter	24	1.5	17
Chesterfield	king size, non-filter	25	1.7	16
Old Gold Straight	king size, non-filter	26	1.8	17
Philip Morris Commander	king size, non-filter	27	1.7	15
Herbert Tareyton	king size, non-filter	27	1.7	19
English Ovals	king size, non-filter, (hard pack)	28	2.1	15
Bull Durham	king size, filter	29	1.9	24

2021574851

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.
3 See statement in text concerning Barclay.

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200)
Varieties of Domestic Cigarettes
(shown in increasing order of nicotine values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Cambridge 3/	king size, filter, (hard pack)	<0.5	<0.05	<0.5
Carlton 3/	king size, filter, (hard pack)	<0.5	<0.05	<0.5
Now 100's 3/	100mm, filter, (hard pack)	<0.5	<0.05	<0.5
Now 3/	king size, filter, (hard pack)	<0.5	0.1	<0.5
Carlton 3/	king size, filter, menthol	<0.5	0.1	1
Carlton 100's 3/	100mm, filter, (hard pack)	<0.5	0.1	1
Benson & Hedges 3/	reg. size, filter, (hard pack)	<0.5	0.1	1
Carlton 3/	king size, filter	<0.5	0.1	1
Cambridge 3/	king size, filter	<0.5	0.1	1
Carlton 100's 3/	100mm, filter, menthol, (hard pack)	<0.5	0.1	1
Tareyton Ultra Low Tar	king size, filter, menthol	1	0.1	1
Barclay 4/	king size, filter, (hard pack)	1	0.1	1
Barclay 4/	king size, filter	1	0.2	1
True Ultra One	king size, filter	1	0.2	1
Now 100's	100mm, filter	1	0.2	1
Now	king size, filter, menthol	2	0.2	3
Now 100's	100mm, filter, menthol	1	0.2	1
Now	king size, filter	2	0.2	3
Barclay 100's 4/	100mm, filter	2	0.3	2
Iceberg 100's	100mm, filter, menthol	2	0.3	4
Merit Ultra Lights	king size, filter, menthol	3	0.3	4
Cambridge 100's	100mm, filter	3	0.3	5
Kent III	king size, filter	2	0.3	3
Merit Ultra Lights	king size, filter	3	0.3	4
Lucky 100's	100mm, filter	3	0.3	4
Triumph	king size, filter, menthol	2	0.3	3
Carlton 100's	100mm, filter, menthol	3	0.3	4
Carlton 100's	100mm, filter	4	0.4	6
Triumph	king size, filter	3	0.4	3
Salem Ultra	king size, filter, menthol	3	0.4	4
Doral II	king size, filter	4	0.4	3
Salem Ultra 100's	100mm, filter, menthol	4	0.4	5
Winston Ultra	king size, filter	4	0.4	5
Doral II	king size, filter, menthol	4	0.4	3
True	king size, filter, menthol	4	0.4	5
Tareyton Lights	king size, filter	5	0.4	5
True	king size, filter	4	0.4	5
Decade	king size, filter, menthol	5	0.4	4
Decade	king size, filter	5	0.4	4
Winston Ultra 100's	100mm, filter	5	0.5	7
Vantage Ultra Lights 100's	100mm, filter	5	0.5	8
Triumph 100's	100mm, filter, menthol	4	0.5	5
Triumph 100's	100mm, filter	4	0.5	6
Kent III 100's	100mm, filter	4	0.5	7

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.
4 See statement in text concerning Barclay.

2021574852

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200
Varieties of Domestic Cigarettes
(shown in increasing order of nicotine values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Merit	king size, filter	7	0.5	10
Merit	king size, filter, menthol	7	0.5	10
Kool Super Lights	king size, filter, menthol	6	0.5	7
Carlton 120's	120mm, filter, menthol	5	0.5	5
Vantage Ultra Lights	king size, filter	6	0.5	9
Pall Mall Extra Light	king size, filter	6	0.5	6
Virginia Slims Lights 100's	100mm, filter, (hard pack)	7	0.6	8
Virginia Slims Lights 100's	100mm, filter, menthol, (hard pack)	7	0.6	8
Salem Lights	king size, filter, menthol	8	0.6	10
Lark Lights 100's	100mm, filter	7	0.6	7
Lark Lights	king size, filter	7	0.6	7
Carlton 120's	120mm, filter	6	0.6	6
Tareyton Long Lights 100's	100mm, filter	7	0.6	7
True 100's	100mm, filter, menthol	8	0.6	9
Camel Lights	king size, filter, (hard pack)	6	0.6	7
Lucky Ten	king size, filter	8	0.6	9
Parliament Lights	king size, filter	9	0.6	10
True 100's	100mm, filter	7	0.6	9
Parliament Lights	king size, filter, (hard pack)	9	0.6	10
Belair 100's	100mm, filter, menthol	8	0.6	10
Arctic Lights 100's	100mm, filter, menthol	7	0.6	9
Arctic Lights	king size, filter, menthol	8	0.6	9
American Lights 120's	120mm, filter, menthol	8	0.7	8
Vantage 100's	100mm, filter	8	0.7	12
Merit 100's	100mm, filter, menthol	9	0.7	11
Viceroy Rich Lights	king size, filter	8	0.7	10
Merit 100's	100mm, filter	10	0.7	12
American Lights 120's	120mm, filter	8	0.7	9
Camel Lights	king size, filter	8	0.7	10
Golden Lights	king size, filter, menthol	8	0.7	8
Vantage	king size, filter	9	0.7	13
Golden Lights	king size, filter	7	0.7	8
Golden Lights 100's	100mm, filter, menthol	7	0.7	7
Benson & Hedges Lights 100's	100mm, filter, menthol, (hard pack)	10	0.7	11
Belair	king size, filter, menthol	8	0.7	9
Kool Super Lights 100's	100mm, filter, menthol	9	0.7	12
Raleigh Lights	king size, filter	8	0.7	11
Marlboro Lights	king size, filter, (hard pack)	10	0.7	12
Newport Lights	king size, filter, menthol, (hard pack)	8	0.7	10
Vantage	king size, filter, menthol	10	0.7	14
Benson & Hedges Lights 100's	100mm, filter, menthol	10	0.7	12
Benson & Hedges Lights 100's	100mm, filter, (hard pack)	11	0.7	11
Marlboro Lights 100's	100mm, filter	10	0.7	12
L & M Lights 100's	100mm, filter	7	0.7	6

2021574853

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200) Varieties of Domestic Cigarettes
(shown in increasing order of nicotine values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Benson & Hedges Light 100's	100mm, filter	10	0.7	13
L & M Lights	king size, filter	8	0.7	7
Marlboro Lights	king size, filter	11	0.7	12
Viceroy Rich Lights 100's	100mm, filter	9	0.8	12
L & M Lights 100's	100mm, filter, menthol	7	0.8	6
Newport Lights	king size, filter, menthol	8	0.8	10
Raleigh Lights 100's	100mm, filter	9	0.8	13
Salem Lights 100's	100mm, filter, menthol	9	0.8	11
Multifilter	king size, filter, menthol	12	0.8	11
Golden Lights 100's	100mm, filter	8	0.8	9
Decade 100's	100mm, filter	8	0.8	7
Multifilter	king size, filter	12	0.8	11
Pall Mall Light 100's	100mm, filter	9	0.8	9
Winston Lights	king size, filter	11	0.9	11
Camel Lights 100's	100mm, filter	12	0.9	15
Marlboro	king size, filter, menthol	14	0.9	14
Parliament Lights 100's	100mm, filter	12	0.9	11
Kool Milds	king size, filter, menthol	11	0.9	12
Winston Lights 100's	100mm, filter	12	0.9	14
Alpine	king size, filter, menthol	14	0.9	13
Hi-Lite 100's	100mm, filter, (hard pack)	12	0.9	13
Marlboro	king size, filter, menthol, (hard pack)	13	0.9	14
Old Gold Lights	king size, filter	10	0.9	10
Galaxy	king size, filter	14	1.0	13
Viceroy	king size, filter	15	1.0	14
Kent	king size, filter, (hard pack)	12	1.0	[illegible]
Tareyton	king size, filter	14	1.0	15
Kool Milds 100's	100mm, filter, menthol	12	1.0	13
Virginia Slims 100's	100mm, filter, menthol	15	1.0	14
Montclair	king size, filter, menthol	14	1.0	16
L & M	king size, filter	14	1.0	15
Kent	king size, filter	13	1.0	13
Virginia Slims 100's	100mm, filter	15	1.0	15
L & M	king size, filter, (hard pack)	15	1.0	14
Raleigh	king size, filter	15	1.0	17
Philip Morris International 100's	100mm, filter, menthol (hard pack)	16	1.0	13
Silva Thins 100's	100mm, filter, menthol	11	1.0	9
Winston 100's	100mm, filter	14	1.0	14
Saratoga 120's	120mm, filter, (hard	15	1.0	16
Saratoga 120's	120mm, filter, menthol, (hard pack)	15	1.0	16
Oasis	king size, filter, menthol	15	1.0	15
Silva Thins 100's	100mm, filter	11	1.0	9
DuMaurier	king size, filter, (hard pack)	15	1.0	17
Marlboro	king size, filter, (hard pack)	16	1.0	14

2021574854

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200)
Varieties of Domestic Cigarettes
(shown in increasing order of nicotine values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Kool Super Longs 100's	100mm, filter, menthol	14	1.0	16
Chesterfield	king size, filter	15	1.0	15
Marlboro	king size, filter	16	1.0	13
Benson & Hedges 100's	100mm, filter, menthol, (hard pack)	16	1.0	15
Tareyton 100's	100mm, filter	14	1.1	16
Pall Mall Light 100's	100mm, filter, menthol	12	1.1	12
Benson & Hedges Lights 100's	100mm, filter, menthol	16	1.1	17
Salem	king size, filter, menthol	14	1.1	14
Benson & Hedges 100's	100mm, filter, (hard pack)	16	1.1	16
St. Moritz 100's	100mm, filter	14	1.1	13
Marlboro 100's	100mm, filter, (hard pack)	16	1.1	16
Marlboro 100's	100mm, filter	16	1.1	16
Philip Morris International 100's	100mm, filter, (hard pack)	16	1.1	16
L & M 100's	100mm, filter	15	1.1	16
Viceroy Super Longs 100's	100mm, filter	15	1.1	16
Benson & Hedges 100's	100mm, filter	16	1.1	16
Winston	king size, filter	15	1.1	16
Lark	king size, filter	14	1.1	14
Raleigh 100's	100mm, filter	16	1.1	17
Eve Lights 120's	120mm, filter, menthol, (hard pack)	14	1.1	12
Chesterfield 101	101mm, filter	15	1.1	16
St. Moritz 100's	100mm, filter, menthol	14	1.1	14
Winston	king size, filter, (hard pack)	16	1.1	15
Spring 100's	100mm, filter, menthol	17	1.1	18
Kool	reg. size, non-filter, menthol	19	1.1	14
Eve Lights 120's	120mm, filter, (hard pack)	14	1.1	13
Kool	king size, filter, menthol	16	1.1	17
Salem 100's	100mm, filter, menthol	15	1.1	14
Eve 100's	100mm, filter	15	1.2	14
Eve 100's	100mm, filter, menthol	15	1.2	[illegible]
Kent 100's	100mm, filter	14	1.2	13
Benson & Hedges	king size, filter, (hard pack)	15	1.2	12
Camel	king size, filter	16	1.2	16
Lark 100's	100mm, filter	16	1.2	15
Pall Mall	king size, filter	18	1.2	18
Newport	king size, filter, menthol, (hard pack)	16	1.2	16
Kool	king size, filter, menthol, (hard pack)	16	1.2	16
Kent 100's	100mm, filter, menthol	15	1.2	14
Pall Mall 100's	100mm, filter	17	1.3	17
Chesterfield	reg. size, non-filter	21	1.3	13
Raleigh	king size, non-filter	22	1.3	17
Half & Half	king size, filter	16	1.3	15
Long Johns 120's	120mm, filter, menthol	16	1.3	17
Newport	king size, filter, menthol	17	1.3	18

2021574855

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.

/0.5 /0.05 /0.5 respectively

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200) Varieties of Domestic Cigarettes
(shown in increasing order of nicotine values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Old Gold Filters	king size, filter	17	1.3	19
Tall 120's	120mm, filter, menthol	16	1.4	17
Picayune	reg. size, non-filter	19	1.4	15
Long Johns 120's	120mm, filter	18	1.4	18
Philip Morris	reg. size, non-filter	21	1.4	12
Winston International 100's	100mm, filter	18	1.4	16
Tall 120's	120mm, filter	17	1.4	19
Camel	reg. size, non-filter	21	1.4	13
More 120's	120mm, filter	18	1.4	20
Lucky Strike	reg. size, non-filter	24	1.5	17
Pall Mall	king size, non-filter	24	1.5	17
More 120's	120mm, filter, menthol	18	1.5	20
Old Gold Filters	100mm, filter	20	1.5	20
Max 120's	120mm, filter	19	1.6	18
Newport 100's	100mm, filter, menthol	20	1.6	20
Max 120's	120mm, filter, menthol	19	1.6	18
Chesterfield	king size, non-filter	25	1.7	16
English Ovals	reg. size, non-filter, (hard pack)	23	1.7	12
Philip Morris Commander	king size, non-filter	27	1.7	15
Herbert Tareyton	king size, non-filter	27	1.7	19
Old Gold Straight	king size, non-filter	26	1.8	17
Players	reg. size, non-filter, (hard pack)	24	1.9	14
Bull Durham	king size, filter	29	1.9	24
English Ovals	king size, non-filter, (hard pack)	28	2.1	15

2021574856

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.

Tar[1], Nicotine[2] and Carbon Monoxide Content of Two-Hundred (200) Varieties of Domestic Cigarettes
(shown in increasing order of carbon monoxide values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Cambridge 3/	king size, filter, (hard pack)	<0.5	<0.05	<0.5
Carlton 3/	king size, filter, (hard pack)	<0.5	<0.05	<0.5
Now 3/	king size, filter, (hard pack)	<0.5	0.1	<0.5
Now 100's 3/	100mm, filter, (hard pack)	<0.5	<0.05	<0.5
Carlton 100's 3/	100mm, filter, (hard pack)	<0.5	0.1	1
Carlton 100's 3/	100mm, filter, menthol, (hard pack)	<0.5	0.1	1
Carlton 3/	king size, filter, menthol	<0.5	0.1	1
Tareyton Ultra Low Tar	king size, filter, menthol	1	0.1	1
Barclay 4/	king size, filter, (hard pack)	1	0.1	1
Cambridge 3/	king size, filter	<0.5	0.1	1
True Ultra One	king size, filter	1	0.2	1
Barclay 4/	king size, filter	1	0.2	1
Benson & Hedges 3/	reg. size, filter, (hard pack)	<0.5	0.1	1
Now 100's	100mm, filter	1	0.2	1
Now 100's	100mm, filter, menthol	1	0.2	1
Carlton 3/	king size, filter	<0.5	0.1	1
Barclay 100's 4/	100mm, filter	2	0.3	2
Now	king size, filter, menthol	2	0.2	3
Triumph	king size, filter, menthol	2	0.3	3
Now	king size, filter	2	0.2	3
Kent III	king size, filter	2	0.3	3
Triumph	king size, filter	3	0.4	3
Doral II	king size, filter	4	0.4	3
Doral II	king size, filter, menthol	4	0.4	3
Merit Ultra Lights	king size, filter, menthol	3	0.3	4
Iceberg 100's	100mm, filter, menthol	3	0.3	4
Merit Ultra Lights	king size, filter	3	0.3	4
Salem Ultra	king size, filter, menthol	3	0.4	4
Decade	king size, filter, menthol	5	0.4	4
Decade	king size, filter	5	0.4	4
Carlton 100's	100mm, filter, menthol	3	0.3	4
Lucky 100's	100mm, filter	3	0.3	4
Cambridge 100's	100mm, filter	3	0.3	5
Winston Ultra	king size, filter	4	0.4	5
True	king size, filter	4	0.4	5
Carlton 120's	120mm, filter, menthol	5	0.5	5
True	king size, filter, menthol	4	0.4	5
Tareyton Lights	king size, filter	5	0.4	5
Salem Ultra 100's	100mm, filter, menthol	4	0.4	5
Triumph 100's	100mm, filter, menthol	4	0.5	5
Carlton 100's	100mm, filter	4	0.4	6
L & M Lights 100's	100mm, filter	7	0.7	6
L & M Lights 100's	100mm, filter, menthol	7	0.8	6
Carlton 120's	120mm, filter	6	0.6	6

2021574857

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200) Variaties of Domestic Cigarettes.
(shown in increasing order of carbon monoxide values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Triumph 100's	100mm, filter	4	0.5	6
Pall Mall Extra Light	king size, filter	6	0.5	6
L & M lights	king size, filter	8	0.7	7
Camel Lights	king size, filter, (hard pack)	6	0.6	7
Kent III 100's	100mm, filter	4	0.5	7
Golden Lights 100's	100mm, filter, menthol	7	0.7	7
Kool Super Lights	king size, filter, menthol	6	0.5	7
Tareyton Long Lights 100's	100mm, filter	7	0.6	7
Lark Lights 100's	100mm, filter	7	0.6	7
Winston Ultra 100's	100mm, filter	5	0.5	7
Decade 100's	100mm, filter	8	0.8	7
Lark Lights	king size, filter	7	0.6	[illegible]
Vantage Ultra Lights 100's	100mm, filter	5	0.5	8
Golden Lights	king size, filter, menthol	8	0.7	8
Virginia Slims Lights 100's	100mm, filter, menthol (hard pack)	7	0.6	8
Golden Lights	king size, filter	7	0.7	8
Virginia Slims Lights 100's	100mm, filter, (hard pack)	7	0.6	8
American Lights 120's	120mm, filter, menthol	8	0.7	8
American Lights 120's	120mm, filter	8	0.7	9
Arctic Lights	king size, filter, menthol	8	0.6	9
True 100's	100mm, filter	7	0.6	9
Pall Mall Light 100's	100mm, filter	9	0.8	9
Golden Lights 100's	100mm, filter	8	0.8	9
Vantage Ultra Lights	king size, filter	6	0.5	9
Belair	king size, filter, menthol	8	0.7	9
True 100's	100mm, filter, menthol	8	0.6	9
Silva Thins 100's	100mm, filter, menthol	11	1.0	9
Arctic Lights 100's	100mm, filter, menthol	7	0.6	9
Silva Thins 100's	100mm, filter	11	1.0	9
Lucky Ten	king size, filter	8	0.6	9
Salem Lights	king size, filter, menthol	8	0.6	10
Newport Lights	king size, filter, menthol	8	0.8	10
Merit	king size, filter, menthol	7	0.5	10
Newport Lights	king size, filter, menthol, (hard pack)	8	0.7	10
Viceroy Rich Lights	king size, filter	8	0.7	10
Camel Lights	king size, filter	8	0.7	10
Belair 100's	100mm, filter, menthol	8	0.6	10
Parliament Lights	king size, filter	9	0.6	10
Parliament Lights	king size, filter, (hard pack)	9	0.6	10
Merit	king size, filter	7	0.5	10
Old Gold Lights	king size, filter	10	0.9	10
Raleigh Lights	king size, filter	8	0.7	11
Benson & Hedges Lights 100's	100mm, filter, menthol, (hard pack)	10	0.7	11
Multifilter	king size, filter, menthol	12	0.8	11

2021574858

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine. [illegible] respectively

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200)
Varieties of Domestic Cigarettes
(shown in increasing order of carbon monoxide values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Winston Lights	king size, filter	11	0.9	11
Parliament Lights 100's	100mm, filter	12	0.9	11
Salem Lights 100's	100mm, filter, menthol	9	0.8	11
Benson & Hedges Lights 100's	100mm, filter, (hard pack)	11	0.7	11
Multifilter	king size, filter	12	0.8	11
Merit 100's	100mm, filter, menthol	9	0.7	11
Viceroy Rich Lights 100's	100mm, filter	9	0.8	12
Marlboro Lights	king size, filter, menthol	10	0.7	12
Benson & Hedges Lights 100's	100mm, filter, menthol	10	0.7	12
English Ovals	reg. size, non-filter, (hard pack)	23	1.7	12
Pall Mall Light 100's	100mm, filter, menthol	12	1.1	12
Kool Super Lights 100's	100mm, filter, menthol	9	0.7	12
Vantage 100's	100mm, filter	8	0.7	12
Kent	king size, filter, (hard pack)	12	1.0	12
Merit 100's	100mm, filter	10	0.7	12
Eve Lights 120's	120mm, filter, menthol, (hard pack)	14	1.1	12
Benson & Hedges	king size, filter, (hard pack)	15	1.2	12
Kool Milds	king size, filter, menthol	11	0.9	12
Philip Morris	reg. size, non-filter	21	1.4	12
Marlboro Lights	king size, filter	11	0.7	12
Marlboro Lights 100's	100mm, filter	10	0.7	12
Vantage	king size, filter	9	0.7	13
Camel	reg. size, non-filter	21	1.4	13
Kent	king size, filter	13	1.0	13
Eve Lights 120's	120mm, filter, (hard pack)	14	1.1	13
Raleigh Lights 100's	100mm, filter	9	0.8	13
Kool Milds 100's	100mm, filter, menthol	12	1.0	13
Benson & Hedges Lights 100's	100mm, filter	10	0.7	13
Hi-Lite 100's	100mm, filter, (hard pack)	12	0.9	13
Chesterfield	reg. size, non-filter	21	1.3	13
Galaxy	king size, filter	14	1.0	13
Alpine	king size, filter, menthol	14	0.9	13
St. Moritz 100's	100mm, filter	14	1.1	13
Kent 100's	100mm, filter	14	1.2	13
Marlboro	king size, filter, menthol	14	0.9	14
Salem 100's	100mm, filter, menthol	15	1.1	14
Salem	king size, filter, menthol	14	1.1	14
Kent 100's	100mm, filter, menthol	15	1.2	14
Marlboro	king size, filter, menthol, (hard pack)	15	0.9	14
Lark	king size, filter	14	1.1	14
Players	reg. size, non-filter, (hard pack)	24	1.9	14
Virginia Slims 100's	100mm, filter, menthol	15	1.0	14
Winston 100's	100mm, filter	14	1.0	14
St. Moritz 100's	100mm, filter, menthol	14	1.1	14

2021574859

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200)
Varieties of Domestic Cigarettes
(shown in increasing order of carbon monoxide values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Vantage	king size, filter, menthol	10	0.7	14
Winston Lights 100's	100mm, filter	12	0.9	14
Kool	reg. size, non-filter, menthol	19	1.1	14
Eve 100's	100mm, filter	15	1.2	14
Eve 100's	100mm, filter, menthol	15	1.2	14
L & M	king size, filter, (hard pack)	15	1.0	14
Marlboro	king size, filter, (hard pack)	16	1.0	14
Camel Lights 100's	100mm, filter	12	0.9	15
English Ovals	king size, non-filter, (hard pack)	28	2.1	15
Half & Half	king size, filter	16	1.3	15
L & M	king size, filter	14	1.0	15
Oasis	king size, filter, menthol	15	1.0	15
Lark 100's	100mm, filter	16	1.2	15
Benson & Hedges 100's	100mm, filter, menthol, (hard pack)	16	1.0	15
Picayune	reg. size, non-filter	19	1.4	15
Winston	king size, filter, (hard pack)	16	1.1	15
Philip Morris International 100's	100mm, filter, menthol, (hard pack)	16	1.0	15
Virginia Slims 100's	100mm, filter	15	1.0	15
Chesterfield	king size, filter	15	1.0	15
Philip Morris Commander	king size, non-filter	27	1.7	15
Marlboro	king size, filter	16	1.0	15
Tareyton	king size, filter	14	1.0	15
Winston	king size, filter	15	1.1	16
L & M 100's	100mm, filter	15	1.1	16
Benson & Hedges 100's	100mm, filter, (hard pack)	16	1.1	16
Saratoga 120's	120mm, filter, menthol, (hard pack)	15	1.0	16
Philip Morris International 100's	100mm, filter, (hard pack)	16	1.1	16
Montclair	king size, filter, menthol	14	1.0	16
Saratoga 120's	120mm, filter, (hard pack)	15	1.0	16
Marlboro 100's	100mm, filter, (hard pack)	16	1.1	16
Viceroy	king size, filter	15	1.0	16
Kool Super Longs 100's	100mm, filter, menthol	14	1.0	16
Camel	king size, filter	16	1.2	16
Newport	king size, filter, menthol, (hard pack)	16	1.2	16
Chesterfield	king size, non-filter	25	1.7	16
Tareyton 100's	100mm, filter	14	1.1	16
Marlboro 100's	100mm, filter	16	1.1	16
Chesterfield 101	100mm, filter	15	1.1	16
Benson & Hedges 100's	100mm, filter	16	1.1	16
Kool	king size, filter, menthol, (hard pack)	16	1.2	16
Winston International 100's	100mm, filter	18	1.4	16
Viceroy Super Longs 100's	100mm, filter	15	1.1	16
Kool	king size, filter, menthol	16	1.1	17
Benson & Hedges 100's	100mm, filter, menthol	16	1.1	17

2021574860

1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.

Tar[1], Nicotine and Carbon Monoxide Content of Two-Hundred (200)
Varieties of Domestic Cigarettes
(shown in increasing order of carbon monoxide values)

BRAND	TYPE	TAR (mg/cig)	NICOTINE (mg/cig)	CARBON MONOXIDE (mg/cig)
Raleigh 100's	100mm, filter	16	1.1	17
Long Johns 120's	120mm, filter, menthol	16	1.3	17
Pall Mall	king size, non-filter	24	1.5	17
Raleigh	king size, non-filter	22	1.3	17
DuMaurier	king size, filter, (hard pack)	15	1.0	17
Lucky Strike	reg. size, non-filter	24	1.5	17
Tall 120's	120mm, filter, menthol	16	1.4	17
Old Gold Straight	king size, non-filter	26	1.8	17
Raleigh	king size, filter	15	1.0	17
Pall Mall 100's	100mm, filter	17	1.3	17
Spring 100's	100mm, filter, menthol	19	1.1	18
Max 120's	120mm, filter	19	1.6	18
Max 120's	120mm, filter, menthol	19	1.6	18
Newport	king size, filter, menthol	17	1.3	18
Pall Mall	king size, filter	18	1.2	18
Long John 120's	120mm, filter	18	1.6	18
Tall 120's	120mm, filter	17	1.4	19
Old Gold Filter	king size, filter	17	1.3	19
Herbert Tareyton	king size, non-filter	27	1.7	19
Newport 100's	100mm, filter, menthol	20	1.6	20
More 120's	120mm, filter, menthol	18	1.5	20
Old Gold Filter 100's	100mm, filter	20	1.5	20
More 120's	120mm, filter	18	1.4	20
Bull Durham	king size, filter	29	1.9	24

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1 TPM dry (tar) - milligrams total particulate matter less nicotine and water.
2 Milligrams total alkaloids reported as nicotine.
3 All scores below 0.5 mg. "tar," 0.05 mg. nicotine and 0.5 mg. carbon monoxide reported as <0.5, <0.05, <0.5, respectively.

EXHIBIT 41

2021574862

FEDERAL TRADE COMMISSION
WASHINGTON. D. C. 20580

OFFICE OF THE SECRETARY

15 DEC 1981

Ernest Pepples
Senior Vice President
and General Counsel
Brown and Williamson Tobacco Corporation
1600 West Hill Street
P.O. Box 35090
Louisville, Kentucky 40232

Dear Mr. Pepples:

The Commission wishes to apprise you of the status of the investigation concerning the request by the R.J. Reynolds Tobacco Company that the cigarette holder currently used in the Commission's Cigarette Laboratory testing procedure be modified. On October 26, 1981, the Commission notified you that no action would be taken until Brown and Williamson's response to the other companies' submissions was reviewed. The Commission instructed the staff to review the material and to prepare a supplemental memorandum reporting the results of that review no later than November 20. Staff has completed and the Commission has reviewed this supplemental memorandum.

The Commission has determined that the substantial evidence obtained to date raises serious questions regarding whether the current testing methodology assesses Barclay's "tar" delivery accurately. Therefore, the Commission has ordered that the attached statement (Attachment I) be included in the new Cigarette Laboratory Report of "Tar," Nicotine and Carbon Monoxide Content of the Smoke of 200 Varieties of Cigarettes. The statement acknowledges the pendency of, and describes the issues raised by, this investigation. The Commission has also ordered that this statement be referenced by a footnote next to the test results for Barclay cigarettes.

Based upon the staff's review of the evidence submitted to date, the Commission has further determined that this investigation is not complete and that a number of scientific questions remain. These questions fall into two general categories. First, a number of methodological concerns have been raised about those studies that appear to be the most probative for resolving this matter. Second, additional information about these same studies appears necessary to evaluate their results. To expedite the resolution of this

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investigation and to give you an opportunity to address these questions and concerns, the staff has prepared the attached list (Attachment II), which describes the methodological concerns that have been raised and the additional information the staff believes is necessary to conclude this investigation.

The Commission appreciates your cooperation to date in this matter and recognizes that you and the other members of the cigarette industry voluntarily have already submitted a substantial amount of scientific evidence. To resolve this important matter as expeditiously as possible, the Commission requests that, if you elect to file any additional comments, data or research in response to Attachment II to this letter, those comments and any supporting data be filed no later than February 15, 1981. Upon receipt of this information, the Commission's consultants on this matter will review this material and submit their final reports to the staff within 30 days. The Commission will provide you with 15 days to review and comment upon the consultants' reports. Based on all of the evidence available, the Commission will then determine what action, if any, to take in this matter.

By direction of the Commission.

Carol M. Thomas
Secretary

Attachments

2021574864

ATTACHMENT I

Statement recommended for inclusion in text of Report of "Tar," Nicotine, and Carbon Monoxide of Smoke of 200 Varieties of Cigarettes

A group of cigarette companies has filed a complaint with the Commission alleging that the current cigarette testing methodology does not accurately assess the "tar" and nicotine that Barclay cigarettes deliver relative to the "tar" and nicotine that other cigarette brands deliver. The complainant cigarette companies further allege that Barclay, a 1 mg. cigarette under the current FTC test method, delivers more "tar" to the smoker than do other 1 mg. "tar" cigarette brands.

The complainant cigarette companies state that a cigarette manufacturer can reduce the "tar" delivery of a cigarette by a variety of different methods. One way to decrease "tar" delivery involves diluting the cigarette smoke inhaled with air brought into the filter through some form of ventilation. The higher the percentage of diluted air inhaled, the lower the "tar" delivery. Methods to increase the amount of air dilution vary among cigarette brands. Many low "tar" cigarettes have a filter surrounded by porous paper with one or more rows of ventilating holes encircling the filter. When the filter is puffed, air enters the filter through the ventilation holes and mixes with the smoke.

In the Barclay filter, air entering the ventilation holes travels into the smoker's mouth through four grooves surrounding the filter. The complainant cigarette companies allege that when consumers smoke Barclay cigarettes, the four grooves either collapse or are in some way blocked. When tested in the FTC laboratory using the current cigarette holder, however, the companies allege that the grooves do not collapse and are not blocked. Thus, it is contended, the Commission's current testing methodology does not accurately measure the relative level of "tar" that Barclay delivers to smokers when compared with other 1 mg. "tar" cigarettes. The Commission is currently investigating these allegations, and has not made a final determination on the merits. An asterisk is appended to the test scores included in this report that this investigation may affect.

Reference accompanying the asterisk next to Barclay's test scores in the tables of the Report "Tar," Nicotine and Carbon Monoxide Content of 200 Varieties of Cigarettes

* See statement in accompanying text concerning Barclay cigarettes.

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ATTACHMENT II

A wide variety of scientific studies have been submitted in this matter. The staff and the Commission's consultants have carefully reviewed each study, and the Commission will consider each study in resolving this controversy. Although questions and concerns have been raised about each study submitted, the staff believes that by providing each cigarette company a specific opportunity to address the questions and methodological concerns raised about the air dilution research submitted by Philip Morris, Inc. and the cotinine research submitted by the Brown and Williamson Tobacco Corporation, this investigation can be most expeditiously concluded.

The following questions and concerns have been raised about the methodology used in the Philip Morris air dilution research.

1.) Questions have been raised about the impact of the sample size on the validity and reliability of the results.

2.) Questions have been raised regarding whether the use of Philip Morris employees as subjects biases the results.

3.) Questions have been raised regarding whether the fact that some of the subjects may have known the purpose of the study biases the results.

4.) Questions have been raised regarding whether the use of Philip Morris employees to conduct this research biases the results.

5.) Questions have been raised regarding whether the special apparatus designed by Philip Morris for this research to measure air dilution prevents normal smoking behavior, and regarding whether the placement of the dental dam on the cigarette filter biases the results against Barclay.

6.) To what extent did the data for each subject tested vary? Does the raw data for each subject still exist? Can it be made available to the Commission staff?

7.) What cigarette did each subject tested customarily smoke? If they smoked a cigarette during the air dilution test different from their customary cigarette, what impact, if any, did this fact have on the results? Was each subject tested also tested on their customary cigarette? If not, why not?

The following questions and concerns have been raised about the cotinine research conducted by Dr. Gio Gori and submitted by Brown and Williamson.

1.) Barclay was the only cigarette tested that yields more than 0.1 mg. nicotine per cigarette by the F.T.C. method. Questions have been raised about the usefulness of this data absent results from other cigarettes with a yield of 0.2 mg. nicotine per cigarette by the F.T.C. method. In addition, it has been suggested that this data be supplemented by tests on a series of cigarettes with yields over 0.2 mg. nicotine per cigarette by the F.T.C. method, in order to evaluate more accurately whether a dose-response relationship exists between the F.T.C. method and the plasma cotinine research. Does this data exist? Can it be made available to the Commission staff? To what extent would this data be useful in evaluating the merits of cotinine research?

2.) The data for the twelve subjects from Study A was extracted from a separate ongoing study. Did that study yield any cotinine data on subjects who smoked cigarettes other than Carlton, Barclay, or Cambridge? If so, what was that data?

3.) Does any cotinine data exist on subjects who smoked cigarettes other than those cigarettes tested in Studies A and B. If so, what is that data?

4.) What scientific literature exists to indicate that cotinine research using the methods and equipment used by Dr. Gori is sensitive and reliable enough to distinguish accurately between, or measure at all, the nicotine yields at issue in this matter.

5.) It has been suggested that one method of validating the existence of a relationship between the F.T.C. testing program and cotinine research is to conduct the cotinine research over a period of time on a large enough sample of smokers, each smoking the cigarette they regularly smoke, to determine whether there are any differences in the cotinine levels between each group of smokers. Although this approach has drawbacks in terms of variations in individual behavior and metabolism, it has the advantage of avoiding potential error in the results due to any smoker compensation from brand switching. Does this type of data exist? If so, what is the data? To what extent would this data be useful in evaluating the merits of cotinine research?

6.) Among those subjects included in Studies A and B, what cigarette brand did each customarily smoke?

7.) To what extent did the data for each subject tested vary? Does the raw data for each subject still exist? Can it be made available to the Commission staff?

8.) On page 13 of Dr. Gori's report, he notes that cotinine recovery averaged 81% in ten samples. To what extent did

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each sample vary? Does the data from this "recovery study" exist? If so, can it be made available to the Commission staff along with a more detailed description of the methodology used in doing the "recovery study?"

9.) What was the analytical calibration curve of the gas chromatograph calibration?

10.) Was data recorded on the height, weight, sex, and age of each subject tested? Can this data be made available to the Commission staff?

The purpose of listing these particular questions and concerns is to help focus the remainder of this investigation. You should feel free however, to comment on or provide additional information about any of the other studies already submitted, or to provide results of additional research, if you so desire.

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Identical letters (not attached) were sent to:

2. Abe Krash, Counsel for PM
3. Joseph Greer, Liggett
4. Samuel Witt, RJR
5. Arthur Stevens, Lorillard
6. Arnold Hensen, American Brands
7. Alexandra Holtzman, PM
8. Ernest Pepples, B&W

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EXHIBIT 42

2021574870

FEDERAL TRADE COMMISSION
WASHINGTON. D. C. 20580

BUREAU OF
CONSUMER PROTECTION

February 2, 1982

Ernest Pepples
Senior Vice President
and General Counsel
Brown and Williamson Tobacco
Corporation
1600 West Hill Street
P.O. Box 35090
Louisville, Kentucky 40232

Dear Mr. Pepples:

Enclosed is a page which was inadvertently omitted from our last circulation. The page should be inserted in the submission entitled Puff Parameter Analyzer, Philip Morris, U.S.A., Research Center, Engineering Services Division, August 14, 1981. This is the second page of text, and should be inserted after the page headed BACKGROUND AND DESIGN CRITERIA.

Secondly, we have received a request from one company that the February 15 submissions be circulated among the six companies, as per our agreement for the other submissions. The company maintains that circulation of the February 15 submissions will facilitate preparation of comments on the consultants' reports. Please notify me as to your company's response to this request.

Sincerely,

Andrew Sacks

Andrew Sacks
Attorney
Division of Advertising Practices

ENCLOSURE PREVIOUSLY MAILED

2021574871

$$\frac{\Delta P}{L} = \frac{3\times10^{-5}}{d^{4}} F \quad \frac{\text{in } H_2O \text{ column}}{\text{in.}} \qquad \{1\}$$

$$Re = \frac{0.05526}{d} F \quad \text{(Dimensionless)} \qquad \{2\}$$

$$L_e = 0.0575 \text{ Red inches} \qquad \{3\}$$

where ΔP = Pressure drop between taps, inches of water column
L = Length of tubing between taps, inches
d = Inside diameter of tubing, inches
F = Flow rate cm^3/min. of ambient air
L_e = Entrance length required to develop laminar flow
Re = Reynolds number = $\frac{du\rho}{\mu}$

u = Gas velocity }
ρ = Gas density } All consistent for dimensionless Re
μ = Gas viscosity}

When Reynolds number, Re, is less than about 2100, flow is laminar. The differential pressure sensor chosen (Validyne DP 103 - .01 psid) has a range of ±0.01 psid or ±0.277 inches of water column. Selecting standard 1/4" outside diameter tubing with 0.035" walls yields an inside diameter of 0.18". The maximum flow rate selected was 5000 cm^3/min., the distance between pressure taps 6.5", and under these conditions, flow equations {1}, {2}, and {3} yield the following:

$$\Delta P = (6.5)\,(3.10^{5})\,(5000)\,(0.18)^{-4} = 0.093\text{" of water column}$$
$$Re = (0.05526)\,(5000)\,(0.18)^{-1} = 1535 < 2100 \therefore \text{laminar flow}$$
$$Le = (0.05526)\,(1535)\,(0.18) = 15.88\text{"}$$

Forming the entrance length tubing into a coil ≈2.5" in diameter showed no effect on the linearity of the sensor tube-pressure transducer combination, and this approach was used to reduce the size of the instrument.

Linearity of the sensor tube pressure transducer response to constant volumetric flows was measured to be ±1 percent of full scale (i.e. ± 50 cm /min.) With each sensor similarly calibrated to produce flow-proportional electrical signals, and with the digital integration and display hardware in place, all that remained was to verify the accuracy of dynamic measurements.

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Identical letters (not attached) were sent to:

2. Arthur J. Stevens, Lorillard
   Michael Gastman, Lorillard
3. Arnold Henson, American Brands
4. Samuel B. Witt III, RJR
5. Joseph H. Greer, Liggett

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EXHIBIT 43

2021574874

Lorillard
A DIVISION OF LOEWS THEATRES, INC. · 2525 EAST MARKET STREET, GREENSBORO, NORTH CAROLINA 27401

February 11, 1982

Andrew Sacks, Esq.
Division of Advertising Practices
Federal Trade Commission
Bureau of Consumer Protection
Washington, D. C. 20580

Dear Mr. Sacks:

Lorillard is in receipt of the Commission's letter of December 15, 1981, wherein the Commission apprises Lorillard of the status of the R. J. Reynolds request regarding the cigarette holder currently used in the Commission's cigarette laboratory testing procedure be modified, and wherein the Commission requests that, should Lorillard elect to file any additional comments, data or research in response to Attachment II to that letter, the comments and supporting data be filed no later than February 15, 1982. Lorillard is also in receipt of the submissions transmitted by your letter of January 8, 1982.

Lorillard encloses herewith its comments on the submissions transmitted to it by the Commission's letter of January 8, 1982, in accordance with the second sentence of the last paragraph of Attachment II of the Commission's letter of 15 December.

Lorillard has enclosed seven (7) copies of its submission and advises the Commission that Lorillard's submission may be circulated among the six (6) companies in line with the Commission procedure followed for the other submissions.

Sincerely,

Michael I. Gastman
Associate General Counsel

Enclosures

MIG/hsh

2021574875

COMMENTS ON THE REPORT OF GORI DATED OCTOBER 22, 1981 USING SERA COTININE AS AN INDICATOR OF CIGARETTE TAR YIELD AND THE REPORT OF DARBY AND McNAMEE

In our prior submission to the Commission, we indicated that the report by Gori failed to provide information such as number of people involved in the tests, initial plasma cotinine levels, the number of cigarettes smoked, time cigarettes were smoked, variability of results, and correlation between FTC smoke yield and serum cotinine. We were, therefore, unable to evaluate the significance of the results.

In this more recent submission, an additional study has been conducted but Gori still does not provide any data establishing a relationship between FTC machine smoked cigarette tar and nicotine yield and serum cotinine. The reader is simply told that the serum cotinine levels that are reported for Barclay, Cambridge, Carlton, and Now are appropriate in that Barclay delivers .2 mg nicotine and the other brands 0.1 mg nicotine. The B&W submission also includes a report by Darby and McNamee who indicate that their analysis of the pharmokinetics of nicotine and cotinine in the human predicts the results obtained by Gori. We believe that Darby and McNamee's report contains a number of significant errors. First, their equation number 1 on page 4 indicates the half-life of nicotine to be 10 minutes. In Gori's paper and elsewhere in the B&W submissions, the half-life of nicotine is suggested to be 30 minutes. Our own analysis of the literature indicates

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it to be about 40 minutes. In equation 2 on page 5 of the Darby report, the signs seem to be reversed, and the half-life of cotinine in plasma is given as 30 hours. Gori also refers to the half-life of cotinine as being 30 hours. Interestingly, the references cited by Darby on the half-life of cotinine are the 1979 edition of the Surgeon General's Report and a report compiled by the ERF of the American Medical Association. We are unable to find a citation of the half-life of cotinine in either of these references.

Zeidenberg, P. et al. (Comprehensive Psychiatry 18:93, 1977) is sometimes cited for the half-life of cotinine, however, no data is given in the paper, and it is only in the introduction that a 30 hour half-life of cotinine is given (without reference). Gritz, E. R. et al. (Clinical Pharmacology and Therapeutics, Vol. 30, No. 2, page 201, 1981) state the half-life of cotinine as 30 hours (reference: Langone, J. J., et al, Biochemistry, Vol. 12, page 5025, 1973). The Langone reference gives data on two different human subjects. They do not, however, specifically calculate the half-life of cotinine from these data. Using their data, we have estimated the half-life of cotinine in sera to be 19 hours. Interestingly, cotinine data in 24 hour urine samples from these same subjects is given in the paper, and this affords a renal half-life of 30 hours. Langone, et al., Research Communications in Chemical Pathology and Pharmacology, Vol. 10, No. 1, page 21, (1975), also contains one set of data for a single subject on sera

cotinine decay, and we have again estimated the half-life at about 19 hours in plasma. We conclude that the half-life of plasma cotinine is not 30 hours and that the extremely limited data on humans gives a half-life of serum cotinine of 19 hours.

Neither the Gori report nor the Darby report provide detail on the number of cigarettes smoked by day or the time of day in which they are smoked, and, therefore, we could not precisely duplicate the calculations to determine the error introduced by the use of erroneous values for nicotine and cotinine half-life. However, we did make some assumptions and estimated the effect of changing these parameters. Since the daily average number of cigarettes consumed by the panelists in the two Gori studies combined was about 28, we used this number as the simulated number smoked on each day. The daily smoking simulation started at 8:30 AM and continued at half-hour intervals until 28 cigarettes had been smoked. The time for calculation of the simulated serum cotinine was chosen as 4:30 PM on the seventh day of the smoking regime. Under these conditions, the Darby model and modified model produced the following sera cotinine levels.

Table 1

Darby Model		Modified Model	
Assumed Amt. of Nicotine Absorbed from Cigarette (mg)	Nicotine half-life (10 min.); Cotinine half-life (1800 min.) Estimated Serum Cotinine (µg/ml)	Assumed Amt. of Nicotine Absorbed from Cigarette (mg)	Nicotine half-life (40 min.); Cotinine half-life (1140 min.) Estimated Serum Cotinine (µg/ml)
.1	90	.1	59
.2	180	.2	118
.3	270	.3	177
.4	360	.4	236

Clearly, these changes in half-life significantly alter the estimated yield from a cigarette when this is to be inferred from the serum cotinine level obtained by Gori and the pharmokinetic model (compare data in Tables I and II).

Table II

Average of all Serum Cotinine Data by Gori

Brand	Cotinine (ng/ml)
Barclay	176
Cambridge	103
Carlton	107
Now	98

The form of the pharmokinetic model proposed by Darby estimates that the level of serum cotinine will increase linearly with the yield of the cigarette providing the same number of cigarettes are smoked at the same times.

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Unfortunately, (as we have previously indicated), no experimental data is provided by Gori to indicate whether or not this is true, and when more appropriate half-lives are included in the model, there is not a 1:1 correspondence between the nominal FTC nicotine yield of the cigarette and the serum cotinine level predicted by the model.

Gori has commented on the design of his experiment where only smokers of the four commercial cigarettes Barclay, Cambridge, Carlton, and Now are used, and they are rotated in a random design among these cigarettes, each for a one week period. Gori states on page 4 of his October 22, 1981 report that smokers of higher tar cigarettes would cause greater variability of results and that their behavior and perhaps smoke metabolism is most likely different from the low-yield smokers, and consequently, the relationship of smoke residues in smokers of high yield cigarettes does not follow a 1:1 proportion, when matched to the nominal FTC yield of the cigarette smoked. Gori also states on page 5 that another experimental approach would be to ask smokers to switch to a higher or lower yield brand and then measure their intake by objective methods. He argues that the results of such an experiment would be distorted by well-known compensatory phenomena which would create great difficulties in interpretation.

To us, this means that Gori believes the cotinine serum level is not directly proportional to the nominal FTC smoke and nicotine yield as nicotine levels of the cigarettes are increased or decreased. This, of course, is

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not the situation represented by the Darby Model.

We agree with these statements by Gori in that they are supported by others. Creighton, D. E. and Lewis, P. H. (Smoking Behavior, Editor Thornton, Churchill-Livingstone, London/New York, page 289, 1978) reported that individuals switched among different yield cigarettes compensated partially or totally for the differences in yields of the cigarettes.

Thus, if Barclay is a higher tar and nicotine yielding cigarette than the others, compensation is to be expected as Barclay is rotated among the smokers. Given this Catch 22 type situation, it is unrealistic for Gori and B&W to consider this limited experiment as definitive.

COMMENTS ON THE REPORT OF GORI DATED OCTOBER 22, 1981 USING EXHALED CARBON MONOXIDE CONCENTRATION AS AN INDICATOR OF CIGARETTE TAR YIELD

In our prior submission to the Commission, we indicated that carbon monoxide content of exhaled breath or the corresponding carboxyhemoglobin level had been used in efforts to distinguish the amount smoked. However, this technique has not been successful due to the lack of an established correlation between smoke intake and carboxyhemoglobin. The problems arise from the fact that carboxyhemoglobin has a relatively short and somewhat variable half-life in the human. The half-life variability is introduced in part by the fact that differing ventilation rates would be incurred under completely sedentary and various ranges of activity.

Gori has used a half-life of five hours, and a diary recording the time that each cigarette was smoked to construct a model for adjusting the carbon monoxide values. We have examined the model as given by his equation at the bottom of page 19 and find that the first term $[CO_m\ (.5)^{(t-t_m)/H}]$ has a relatively small value and contributes only about 10% of the expired carbon monoxide value measured late in the afternoon.

If we assume that cigarettes are smoked beginning at 8:30 AM and continuing at half-hour intervals until 3:30 PM (the approximate time at which Gori indicates he conducted the analysis), the following value results for the second term in his equation:

$$U \sum_{i=1}^{15} \begin{array}{l} .353 + .378 + .406 + .435 + .466 + .500 + .538 + \\ .570 + .615 + .659 + .707 + .758 + .815 + .870 + .933 \end{array}$$

This means that the exhaled carbon monoxide value has little dependence on the prior day's smoking and a decreased dependence on the cigarettes smoked early in the day, or conversely, a high dependence on the last few cigarettes smoked. This, of course, means that there is very little averaging of the smokers' habits and, therefore, high variability of results is to be expected. Gori's data is reflective of this, in that standard errors are frequently found to be 50% of the mean.

Again, Gori fails to provide any information which would suggest that a correlation exists between the FTC carbon monoxide yield of a cigarette and the carbon monoxide

concentration in the exhaled breath of a smoker. Interpretation of the data is also complicated by possible smoker compensation for higher yielding products in a study such as this where cigarettes are rotated among smokers over a relatively short time period.

We conclude that these data suffer from the same problems as the cotinine measurements and their interpretation, except that the carbon monoxide data are less meaningful because of the shorter half-life, probable greater half-life variability, and high dependence on the last few cigarettes smoked.

COMMENTS ON THE OCTOBER 23, 1981 SUBMISSION BY PAUL, WEISS, RIFKIND, WHARTON & GARRISON ON BEHALF OF BROWN AND WILLIAMSON

On page 24 of this document, Brown & Williamson comments on the September 1, 1981 submission by Lorillard to the FTC. They call the experiment bizarre, apparently on the basis of a lack of correlation between the ratio of tar delivered by a number of Lorillard brands to that delivered by Now and the FTC tar. They depict this data in graphic form on page 25 and label the ordinate "'Smoke in a Bottle' Relative to Now" and the abscissa "Mg 'Tar' Advertized by FTC Method" and give the figure the title "How Some Lorillard Employees Apparently Smoke Lorillard Products". These data represent single cigarettes each smoked by a different individual.

Creighton, D. E., Noble, M. J., and Whewell, R. T. (Smoking Behavior, Edited by Thornton, Churchill-Livingstone London/New York, 1978, p. 277-300) have reported a device to measure, record, and duplicate human smoking patterns. They recorded human puff volumes, puff velocities, puff intervals, puff numbers, and puff profiles on punch tape, and these were used to program the smoking machine. Tar, nicotine, and carbon monoxide were measured under the various conditions recorded for human smoking which can be compared to the standard conditions used by the FTC. The tar obtained in the oral cavity, as reflected by their smoking patterns, varied from +200% to -80% of the machine value at standard conditions. (Incidentally, this book was edited by a senior scientist from the Group Research and Development Center at BAT, the parent company of Brown and Williamson. B&W scientists were listed as present at the symposium where the papers were originally given.) This means that the ratio for individual brands on single cigarette smokings by individual smokers reported previously by Lorillard and termed bizarre by Brown and Williamson fall generally within the range of variation reported above and is well known to B&W. We conclude that Lorillard employees smoke in a manner similar to BAT employees.

Brown and Williamson's further statement that "according to Lorillard's data, the FTC, to be accurate should adopt a filter holder that obtains higher tar delivery for Kent III cigarettes (3 mg per current FTC method) than for Golden Lights (7 mg), higher tar delivery

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for Golden Lights than for Kents (12 mg), and equivalent tar levels for True (5 mg) and Newport Red (14 mg)" has no meaning, and can only arise from their total misunderstanding of the reported information. We report under Attachment 2 and Table 1 the effect that the PM holder would have on the tar yield of a number of brands. Only the tar yield of Barclay is changed significantly from that obtained with the holder currently used by the FTC.

The major point of the submission under Attachment 1 relates to the relative yield of tar obtained by individual smokers from Carlton, Now, Barclay cigarettes, and their own brand. Each of the individual 20 smokers obtained more tar from the Barclay cigarettes than they did from the Now, and frequently the amount obtained from the Barclay was as high as that obtained from their regular Lorillard brand. Additionally when we average the ratios obtained from the twenty smokers on Carlton, Now and Barclay cigarettes, we report that the Barclay delivers about four times as much tar to the smoker's oral cavity as the Now and 3.3 times as much as the Carlton. These data correlate well with the higher taste levels associated with Barclay by R. J. Reynolds' submission and Lorillard's own taste panel data. They also agree with the data submitted in the Philip Morris butt study.

We believe that the Lorillard data result from a direct measure of the relative amount of tar delivered by Barclay cigarettes to a random group of smokers with respect to the tar level of their regular brand. No

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assumptions are made concerning the ratio of tar to other smoke components as in the butt studies and the Gori experiments.

COMMENTS ON THE TECHNICAL APPENDIX DATED OCTOBER 23, 1981 ACCOMPANYING THE SUBMISSION TO THE FTC ON BEHALF OF BROWN AND WILLIAMSON

We find this material somewhat confusing, particularly if the reader does not have a thorough understanding of the dependence of tar and other smoke components on the smoking parameters. For example, Brown and Williamson on page 9, Figure B, indicates that puff volume has a greater effect on retained nicotine than does velocity. Although true, the question is "Is there a relationship between puff volume and the retention efficiency of the filter?" The answer to that question is "No". The retention characteristics of the filter do change with smoke velocity as previously pointed out by Lorillard and Philip Morris. The assumption inherent in any butt study is that the filtration efficiency of the filter must be assumed as a constant. The principal variable affecting filtration efficiency is smoke velocity. The construction of the Barclay filter is such that smoke velocity through the filter under FTC smoking conditions is very low (with approximately 80% ventilation behind the filter). Occlusion of the air channels at constant puff volume and duration alters smoke velocity through the filter, and filtration efficiency drops significantly (as pointed out in Lorillard's earlier submission).

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Thus, it is impossible to consider a butt study valid with this type cigarette unless the dilution under human smoking conditions is known. We have also pointed out previously that the relationship between filtration efficiency and smoke velocity is exponential, and a 50% increase in velocity (for example, a combination of decreased ventilation and increased puff volume of constant duration) produces a rather dramatic effect on the tar delivered. This could easily account for the results obtained by Lorillard in the study reporting data on the delivery of Barclay to human volunteers.

2021574887

EXHIBIT 44

2021574888

ARNOLD & PORTER
1200 NEW HAMPSHIRE AVENUE, N. W.
WASHINGTON, D. C. 20036
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CABLE: "ARFOPO"
TELECOPIER: (202) 872-6720
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1660 LINCOLN STREET
DENVER, COLORADO 80264
(303) 832-2900

ABE KRASH
DIRECT LINE: (202) 872-6752

February 16, 1982

FEDERAL TRADE COMMISSION
RECEIVED
FEB 18 1982
Division of
Food & Drug Advertising

BY HAND

Andrew Sacks, Esquire
Division of Advertising Practices
Bureau of Consumer Protection
Federal Trade Commission
Room 6124, Old Star Building
414 - 11th Street, N.W.
Washington, D.C. 20580

Re: Barclay Filter Investigation

Dear Mr. Sacks:

On behalf of Philip Morris Incorporated, we are transmitting herewith a memorandum prepared by the Philip Morris Research Center which responds to the questions regarding the Barclay filter raised by the Commission in its letters of December 15, 1981 addressed to attorneys for each of the cigarette companies. The memorandum answers those questions raised with respect to the scientific data previously submitted by Philip Morris, and the memorandum also discusses the cotinine experiment on which Brown & Williamson has relied.

In addition to this memorandum, we are submitting herewith the report of a leading independent testing organization, United States Testing Company, Inc., describing the results of an intensive study of cigarette dilution involving more than 500 smokers. This report strongly confirms the conclusion that the bypass filter used by Brown & Williamson on Barclay and other cigarette brands functions one way in the Commission's smoking machine and in an altogether different way in a smoker's lips. Barclay and similar products are the only cigarettes tested which show these abnormal

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characteristics. This study demonstrates dispositively that the Commission's current testing methodology does not assess Barclay's "tar" delivery accurately.

In response to the questions raised by the Commission in its letter of December 15 concerning the Brown & Williamson cotinine experiment, we are submitting herewith statements by three of the country's most distinguished experts on this subject. These authorities conclude that B&W's experiment is of no scientific value and does not support that company's arguments with respect to the "tar" delivery of Barclay.

As we have previously stated to the Commission, Philip Morris believes that the serious threat to the integrity of the Commission's testing program posed by Barclay can be resolved by utilizing the holding device recommended by Philip Morris in the Commission's cigarette testing laboratory. Use of this holding device will ensure accurate and reliable comparative "tar" data for all cigarette brands.

We will endeavor to answer promptly any further questions which the Commission or the Staff may have regarding this matter.

Sincerely yours,

ARNOLD & PORTER

By Abe Krash
Abe Krash

Attorneys for Philip Morris Incorporated

Enclosures

cc: Timothy J. Muris, Esquire
Wallace S. Snyder, Esquire

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MEMORANDUM OF PHILIP MORRIS INCORPORATED TO THE FEDERAL TRADE COMMISSION IN REPLY TO QUESTIONS RAISED BY THE COMMISSION'S STAFF IN CONNECTION WITH THE INVESTIGATION OF THE BARCLAY FILTER

Philip Morris Research Center
Richmond, Virginia

February 16, 1982

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MEMORANDUM OF PHILIP MORRIS INCORPORATED TO THE FEDERAL TRADE COMMISSION IN REPLY TO QUESTIONS RAISED BY THE COMMISSION'S STAFF IN CONNECTION WITH THE INVESTIGATION OF THE BARCLAY FILTER

INTRODUCTION AND SUMMARY

Philip Morris Incorporated submits this memorandum in response to the Commission's letter of December 15, 1981 regarding the Barclay filter investigation.1/ In that letter, the Commission announced its determination "that the substantial evidence obtained to date raises serious questions regarding whether the [Commission's] current testing methodology assesses Barclay's 'tar' delivery accurately." The Commission also established a program for expedited resolution of these serious questions now clouding the integrity of the Commission's cigarette testing program.

We are submitting herewith the report of a leading independent testing organization, United States

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1/ When the Commission's investigation began, the five styles of Barclay were the only cigarettes employing the bypass filter. Use of the bypass filter has since spread, however, to other Brown & Williamson brands -- Kool Ultra and reportedly Viceroy Ultra Rich Lights -- and further proliferation may be imminent. References herein to "Barclay" should be understood, unless the context indicates otherwise, to apply to all brands fitted with the same type of filter.

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Testing Company, Inc. ("U.S. Testing"), on the results of that company's recent extensive study of cigarette dilution involving more than 500 smokers. The U.S. Testing report and this memorandum supplement and confirm the overwhelming body of scientific evidence already presented to the Commission establishing that the bypass filter employed on Barclay -- and now being installed by Brown & Williamson on other heavily promoted cigarette brands -- is duplicitous in its design and operation. Unlike any other filter that we have ever seen or examined, the Barclay filter functions one way in the Commission's smoking machine and in a radically different way in a smoker's lips. Effective corrective action by the Commission is urgently required.

In its letter of December 15, 1981, the Commission requested supplemental submissions focusing on two issues: (i) the methodology used in the dilution measurement studies previously submitted by Philip Morris, and (ii) the validity and relevance of the cotinine experiment submitted by Brown & Williamson Tobacco Corporation. We discuss more fully below the following points:

First, the Philip Morris dilution measurements dramatically demonstrate that Barclay, unlike any other brand, yields significantly lower dilution when smoked

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in the lips than in the Commission's machine. For that reason, Barclay's "tar" delivery is not comparable to that of other brands measuring 1 mg. by the current FTC method. As shown by our specific responses to each of the Commission's questions, the previously submitted dilution measurements are based on sound, scientific methods.

Second, the conclusions of the Philip Morris dilution study have been replicated and validated through a meticulous, large-scale, independent study, involving more than 500 smokers, designed and conducted in January and February 1982 by United States Testing Company, one of the nation's leading testing organizations. The U.S. Testing study, conducted pursuant to a request by Philip Morris, is described in detail below, and all of the data generated in the study are available to the Commission. This extensive survey demonstrates, beyond any doubt, that the dilution of Barclay drops dramatically when it is smoked in the lips; that this phenomenon does not occur in cigarettes without a Barclay-type filter; and that, when measured at its human dilution level, Barclay delivers about 8 mg. "tar" by FTC method. Contrary to Brown & Williamson's advertising, Barclay is not an ultra low "tar" cigarette.

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Third, Brown & Williamson's defense rests primarily on an experiment purportedly measuring the plasma cotinine levels in the blood of smokers involuntarily switched from 1 mg. "tar" cigarettes to Barclay. As explained below and in the accompanying letters from three eminent experts, Dr. Herbert McKennis, Dr. Paul Larson, and Dr. Neal Castagnoli, B&W's experiment is of no scientific value, and may not properly be relied upon to draw conclusions about the smoke deliveries of particular cigarette brands.

Fourth, it is noteworthy that B&W's own cotinine data -- unscientific as they are -- actually confirm the duplicitous character of Barclay. While the nicotine deliveries of Barclay, Carlton and Cambridge under current FTC machine smoking conditions are very similar, the plasma cotinine levels of smokers switched from Carlton or Cambridge to Barclay appeared to increase, frequently by as much as 100 to 200 percent or more. As noted by researchers in this area and acknowledged in B&W's papers, such an increase suggests that Barclay delivers many times more "tar" than Cambridge or Carlton.

The Commission has been investigating the Barclay filter for many months, and it has received extensive

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analyses and data from cigarette company research departments and from outside consultants. Particularly in view of the U.S. Testing report, there is now overwhelming evidence that the Commission's current testing methodology does not assess Barclay's "tar" delivery accurately. Because of Barclay's substantial dilution differential when smoked in the lips rather than in the Commission's current lip-less holding device, Barclay cannot and should not be ranked at the same level as other cigarettes measured at 1 mg. "tar" by FTC method. The complex and unsound cotinine experiment proffered by B&W provides, if anything, further confirmation of this conclusion. The Commission should not delay any further in taking the necessary action to restore and maintain the integrity of its cigarette testing program. Specifically, we urge that the Commission utilize in its cigarette testing laboratory the holding device recommended by Philip Morris to obtain accurate and reliable comparative "tar" data.

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DISCUSSION

I. LARGE-SCALE, SCIENTIFICALLY VALID DILUTION STUDIES DEMONSTRATE THAT BARCLAY DELIVERS SUBSTANTIALLY HIGHER "TAR" WHEN SMOKED IN THE LIPS THAN ANY OTHER CIGARETTE MEASURED AT 1 MG. "TAR" BY THE CURRENT FTC METHOD.

It is an accepted fact that cigarette dilution is a significant determinant of the delivery of "tar," nicotine, carbon monoxide, and other smoke components; indeed, in very low delivery cigarettes, dilution is by far the most significant determinant. Dilution and "tar" delivery are inversely related: the higher the dilution percentage, the lower the "tar" yield, and vice versa.

As we previously demonstrated in memoranda submitted to the Commission, when a Barclay cigarette is puffed on a smoking machine, the four peripheral air channels of the bypass filter produce an extremely high level of dilution air -- in excess of 70% -- with a concomitantly low "tar" delivery. However, when a Barclay cigarette is puffed in the lips of a smoker, there is substantial blockage or occlusion of the channels by the smoker's lips, and dilution drops dramatically, typically to the 45% range and often much lower. When Barclay's dilution is reduced to 45%, it

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becomes an 8 mg. "tar" cigarette by FTC method. No other cigarettes, except brands with a Barclay-type filter, experience any significant change in dilution when puffed in the lips.

In July 1981, Philip Morris submitted to the Commission the results of a study demonstrating the difference in the dilution of Barclay between machine and in-lip smoking. We have provided a detailed description of the development and operation of the Puff Parameter Analyzer ("PPA"), the on-line scientific equipment that measures the actual dilution of cigarettes puffed by human smokers. In addition, we have demonstrated the operation of the PPA to members of the Commission's staff and to representatives and scientific consultants of Brown & Williamson.2/

The aerodynamic and electronic design of the PPA equipment has not been questioned. As noted by Professor Sheila Widnall of the Massachusetts Institute

2/ On August 26, 1981, at B&W's request, Philip Morris demonstrated the operation of the PPA at the home of a B&W engineering consultant in Cambridge, Massachusetts, to permit him to comment on the operation of the equipment. During that demonstration, representatives of both B&W and the Commission's staff puffed Barclay cigarettes on the PPA, and recorded drastically lower dilution when the cigarette was held in the lips than when it was puffed through a mouthpiece.

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of Technology, an eminent scientist and independent consultant who was asked to review the PPA, the dilution measurement equipment is not only well designed and constructed, but inherently more accurate than the equipment which is available to test the PPA.

The only questions that have been raised regarding the dilution study conducted by Philip Morris deal with the methodology used in that study. Those questions are answered below in detail. We shall demonstrate that the study conducted and the methodology employed by Philip Morris were sound, valid, and entirely sufficient to establish the duplicitous character of the bypass filter. In any event, any methodological questions raised about the Philip Morris dilution study have been obviated by the large-scale independent dilution study conducted by U.S. Testing.

A. <u>The Large-Scale United States Testing Study</u>

In order to resolve any question that might be raised regarding the methodology of the dilution studies submitted to the Commission by Philip Morris -- including the questions set forth in the Commission's letter of December 15, 1981 -- shortly after receiving the Commission's letter, we asked United-States Testing

Company to develop and conduct a large-scale study of Barclay's dilution.

Philip Morris provided U.S. Testing with three Puff Parameter Analyzers and instructed the testing company's scientific personnel in the machines' operation. We asked U.S. Testing's Consumer Research Division to design and conduct a study, with whatever controls it deemed appropriate, (i) to compare the dilution of Barclay when puffed in a smoker's lips with the dilution of Barclay when puffed in a mouthpiece, and (ii) to make the same dilution comparison for the smoker's own brand and for several other brands of varying dilution.

The basic study designed and conducted by U.S. Testing involved 500 smokers, a demographically selected sample reflecting the age, sex, and cigarette brand distribution of smokers in the population. U.S. Testing measured the dilution experienced by each smoker on five brands of cigarettes: the smoker's own brand, Barclay, Carlton, Merit and "Extended Filter," a special cigarette made by fitting an extra-long Barclay-type filter to a standard Cambridge tobacco rod.[3/] Every

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3/ The Extended Filter cigarettes have the same bypass filter as Barclay except that the ventilation perforations are 17 millimeters from the mouth-end of the

[Footnote continued on following page]

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cigarette was puffed both while held in a mouthpiece -- so that the smoker's lips could not touch it -- and also while held directly in the lips.

1. Results of the United States Testing Study

The U.S. Testing study fully confirms the results of the earlier Philip Morris studies: that the dilution of Barclay-type cigarettes, alone among all brands, drops dramatically when those cigarettes are puffed in a human smoker's lips. When a Barclay-type cigarette is held in a mouthpiece and puffed, it produces a dilution similar to that produced in a smoking machine. When the mouthpiece is removed, however, Barclay becomes a very different cigarette.

The averages for 500 smokers are as follows:

Brand	Average Percent Dilution (cigarette held in mouthpiece)	Average Percent Dilution (cigarette held in lips)
Respondent's Own Brand	24.5	24.5
Carlton	69.1	69.5

[Footnote continued]
filter. When such a cigarette is placed in the PPA's glass holder, 15 to 16 millimeters of cigarette tip are available to the smoker's lips. The Extended Filter was used in these tests to remove any doubt that the PPA leaves enough tip available for the smoker to hold a Barclay-type cigarette in his lips in his normal way. (*See* p. 24, below.)

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Merit	32.4	33.2
Barclay	73.1	45.6
Extended Filter[4/]	72.2	32.2

In other words, when Barclay is held in a mouthpiece -- or in a dental dam in the Commission's smoking machine -- on average only 26.9% (100% minus 73.1%) of the puff is drawn through the tobacco rod as opposed to the dilution perforations. However, when Barclay is held in an average smoker's lips, more than twice as much, 54.4% (100% minus 45.6%) of the puff is drawn through the tobacco rod. Moreover, the greater tobacco rod delivery during the puff duration means that the smoke is delivered at a much higher flow rate, and, as we have demonstrated in prior submissions, the

4/ As noted earlier, the Extended Filter cigarette was included in the study to determine whether any drop in Barclay's dilution might be caused by a failure to provide smokers with an adequate length of filter to hold in their lips. In fact, the Philip Morris Extended Filter cigarette recorded a somewhat greater drop in dilution than Barclay regardless of how much of the filter was made available to smokers. We believe that this was because of tighter quality control in the manufacture of the Extended Filter cigarettes -- holes or tears in the non-porous plugwrap of a bypass filter can moderate the dilution drop somewhat. Accordingly, it appears that unless the Commission modifies the holding device in its smoking machine as has been suggested, other manufacturers may be able to exploit the present loophole even more effectively than Brown & Williamson.

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efficiency of the Barclay filter declines sharply at those high flow rates. Accordingly, as measured by FTC method, when Barclay's unlit dilution is reduced to the 45% range, it delivers about 8 mg. "tar."

For reasons described below, the principal U.S. Testing study was performed with unlit cigarettes. Over 100 smokers were also tested with lit cigarettes, however, and the results were completely consistent:5/

Brand	Average Percent Dilution (cigarette held in mouthpiece)	Average Percent Dilution (cigarette held in lips)
Respondent's Own Brand	37.7	37.0
Carlton	76.3	75.7
Merit	42.7	42.9
Barclay	79.9	55.6
Extended Filter	80.0	42.0

Again, these lit data confirm that the smoke component of a Barclay puff more than doubles when the cigarette is held in the lips, soaring from 20.1% to 44.4%, with

5/ The dilution of any diluted filter cigarette increases upon lighting. This is because the burning coal impedes air flow through the rod, and dilution air accordingly becomes comparatively easier to draw.

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an attendant increase in smoke flow rate and concomitantly reduced filtration efficiency.

It might be observed that, of the 500 smokers in U.S. Testing's demographic sample, only 8 were regular smokers of Barclay cigarettes. U.S. Testing questioned whether this sample was sufficient to determine whether the drop in Barclay dilution was experienced not only by smokers generally, but specifically by regular Barclay smokers. Accordingly, a separate sample of 47 Barclay smokers was obtained. The data for those 47 smokers were essentially identical to those for the panel as a whole:

Unlit Data

Brand	Average Percent Dilution (cigarette held in mouthpiece)	Average Percent Dilution (cigarette held in lips)
Respondent's Own Brand (Barclay)	73.4	43.1
Carlton	71.1	70.2
Merit	31.4	31.3
Barclay	76.8	49.9
Extended Filter	71.9	33.4

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Brand	Lit Data: Average Percent Dilution (cigarette held in mouthpiece)	Lit Data: Average Percent Dilution (cigarette held in lips)
Respondent's Own Brand (Barclay)	79.8	54.6
Carlton	80.7	79.4
Merit	41.7	41.0
Barclay	82.8	60.2
Extended Filter	80.5	45.4

As we have demonstrated to the Commission in the past, it is possible to measure the "tar" delivery of cigarettes by FTC method at varying dilutions by modifying the tipping paper to control ventilation. Based on such measurements of commercial cigarettes at varying dilutions, Barclay KSSP at the dilution obtained when smoked on a smoking machine or through a mouthpiece has a "tar" delivery similar to that of Carlton KSSP, about 1 mg. However, Barclay KSSP at the dilution obtained when smoked in the lips has a "tar" delivery similar to that of Merit KSSP, about 8 mg.

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2. Methodology of the United States Testing Study

The study conducted by U.S. Testing was rigorous, objective and complete. The sample was large, scientifically selected and representative of the general smoking population. No one connected with Philip Morris participated in the testing in any way. The test subjects were not aware of the sponsor or the purpose of the study, and particular care was taken to prevent the subjects from seeing any of the data generated by the PPA.

As noted above, each test subject puffed five brands of cigarettes -- his own brand, Barclay, Carlton, Merit, and an Extended Barclay-type Filter cigarette. All commercial cigarettes were purchased by U.S. Testing from regular outlets, and were not preselected in any way. If a subject's regular brand was a 100 mm. product, Barclay 100's, Carlton 100's, and Merit 100's were used; if a subject's regular brand was a mentholated product, Barclay Menthol, Carlton Menthol, and Merit Menthol were used.

Each test subject puffed first on one of his own cigarettes to accustom him to the machine. The order of presentation of the other cigarettes was

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rotated; the test subject was not permitted to see the names on any of the cigarettes. Each cigarette was placed in turn in the machine's holder with the mouth-end protruding at least 10 mm.6/ A mouthpiece was then placed on the mouth-end of the cigarette, and the cigarette was puffed by the subject three times. The mouthpiece was then removed, and three puffs were taken with the cigarette held directly in the subject's lips.7/

For a number of reasons, the principal study was done on unlit cigarettes. First, the cigarette industry has traditionally measured dilution with unlit cigarettes, and it was desired to remain as close to the customary practice as possible. Second, lighting the cigarette destroys it, making it impossible to recheck the cigarette later for anomalies. Third, because the vessel containing a lit cigarette must be cleared after each puff and cleaned periodically,

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6/ Because of the greater distance of the ventilation perforations from the mouth-ends of the Barclay 100 and Extended Filter cigarettes, 13 mm. of the Barclay 100 filter were made available to the smokers' lips, and at least 15 mm. of the Extended Filter were made available to the smokers' lips.

7/ Analysis of spent Barclay filters suggests that some smokers permanently crush or crimp the peripheral channels of the bypass filter when smoked in the lips. For this reason, measurements were always made first with the mouthpiece.

dilution testing with lit cigarettes is a substantially slower process. Finally, and perhaps most important, requiring a smoker to puff lit cigarettes of an unfamiliar brand might in theory cause him to alter his regular smoking patterns.8/ Nevertheless, to make certain that the use of unlit cigarettes did not distort the results, U.S. Testing undertook to measure dilution on lit cigarettes for at least 100 subjects. As noted above, the results achieved on lit cigarettes were fully consistent with and confirmed the results of the unlit cigarette tests.

As previously noted, a copy of the U.S. Testing report is being submitted to the Commission together with this memorandum. In addition, all cigarettes, mouthpieces, butts, and PPA data tapes have been retained, and will be made available to the Commission upon request.

To our knowledge, no more intensive study has ever been made of the dilution of any cigarettes. The conclusion is clear and unmistakable: Alone among all

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8/ For example, because Barclay is substantially higher in "tar" than 1 mg. cigarettes such as Carlton or Cambridge, it was feared that a Carlton or Cambridge smoker might not feel comfortable taking his normal puff on a lit cigarette such as Barclay.

cigarettes, the dilution of Barclay -- and the other now-proliferating brands fitted with the same bypass filter -- drops dramatically when smoked in the mouth, to the 45% region. At 45% dilution, Barclay is an 8 mg. "tar" cigarette by FTC method.

B. Response to the Commission's Questions Regarding the Philip Morris Dilution Study

The questions raised in Attachment II to the Commission's letter of December 15, 1981 regarding the methodology of the Philip Morris dilution studies have been rendered academic by the U.S. Testing study. Nevertheless, we have always been fully satisfied that there is no legitimate basis for challenging the methodology employed in the Philip Morris studies, and we respond to each of the Commission's questions as follows:

1. "Questions have been raised about the impact of the sample size on the validity and reliability of the results."

The initial study submitted by Philip Morris to the Commission included data for 45 smokers. Every one of these smokers registered a substantial drop in the dilution of Barclay cigarettes when smoked in the lips, and none of these smokers registered a substantial

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drop in dilution for any other cigarette brand. The likelihood of such a result being obtained purely by chance is negligible. The consistency and magnitude of Barclay's drop in dilution are significant by any statistical test. Moreover, samples of the size involved in the Philip Morris dilution study, or smaller, are frequently relied upon in clinical research and objective, product-characteristic testing.

As discussed above, the studies conducted by U.S. Testing included more than 500 smokers and also produced consistent and substantial decreases in dilution when Barclay was puffed in the smokers' lips.

2. "Questions have been raised regarding whether the use of Philip Morris employees as subjects biases the results."

In the regular course of business, Philip Morris conducts numerous studies of its own cigarettes, proposed new cigarettes, and competitors' cigarettes. The subjects employed in the original Barclay dilution study were obtained from the regular panels used at Philip Morris for product testing, and represent a good mixture of smokers of different habits who regularly smoke different kinds of cigarettes. Over the years, we have found that Philip Morris employees can be relied upon

to give valid, reproducible data, and the company relies upon those data in making significant product and marketing decisions. We believe that every other company in the cigarette industry, and numerous companies in many other industries, commonly rely on their own employees for product testing.

It should be emphasized that the Barclay studies did not call for subjective impressions. Rather, the tests measured the impact on dilution, as measured by scientific equipment, when Barclay and other cigarette brands are puffed in smokers' lips. It is difficult to believe that the lips of Philip Morris employees function any differently from those of smokers generally.

As noted above, the same dilution drop for Barclay was recorded by FTC staff members and by Brown & Williamson employees and consultants. (See note 2, above.) Moreover, the subjects employed in the large-scale U.S. Testing studies were not affiliated with Philip Morris or any other cigarette manufacturer in any way.

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3. "Questions have been raised regarding whether the fact that some of the subjects may have known the purpose of the study biases the results."

At least three points should be noted in response to this inquiry. First, the initial dilution studies of Barclay cigarettes were conducted soon after introduction of the product, long before Philip Morris had taken any position whatever with regard to the bypass filter. Our only real "purpose" at that time was to better understand a new competitive product.

Second, we seriously doubt that many of the persons involved in the tests knew or cared what "purpose" Philip Morris may have had in mind. Testing new products -- both our own proposed cigarettes and competitive brands -- goes on continually at Philip Morris, and our regular subjects consider such tests a matter of routine.

Third, even if some member of the panel had divined the nature of the study being conducted, we think it would have been extremely difficult, if not impossible, for him to have biased the results. This was not a subjective study in which the candor and objectivity of the subjects were relied upon. The

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subjects were merely seated with their back to a machine and asked to puff on cigarettes in their regular manner. Moreover, all participants in the study produced substantially similar results; the possibility that some panelists may have known something about the study could not have produced this remarkable consistency.

All of the more than 500 test subjects employed by U.S. Testing in its dilution studies were told absolutely nothing about the sponsor or purpose of the studies, or the kind of data being generated.

4. "Questions have been raised regarding whether the use of Philip Morris employees to conduct this research biases the results."

The personnel that conducted the original dilution measurement studies were nonprofessional Philip Morris employees who regularly conduct panel testing of various kinds. They were fully familiar with the operation of the dilution measurement equipment, and were instructed to perform an objective, rigorous test to measure the parameters of cigarette puffing in a fair and accurate manner. While incorrect operation of the equipment could lead to distorted data, those distortions generally result in physically improbable

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flow rates and are obvious upon inspection of the data. The data generated in the studies in question have been scrutinized in considerable detail. Those data are internally consistent, and also consistent with proper operation of the equipment and proper test procedures.

The large-scale studies performed by U.S. Testing were conducted exclusively by that testing organization's own personnel.

> 5. "Questions have been raised regarding whether the special apparatus designed by Philip Morris for this research to measure air dilution prevents normal smoking behavior, and regarding whether the placement of the dental dam on the cigarette filter biases the results against Barclay."

In order to measure cigarette dilution during human puffing, the mouth-end of the cigarette must remain open and unobstructed for the smoker to puff upon and both the end of the rod and the dilution perforations must be encapsulated so that the flow of air through each can be measured. Subject to those inherent design requirements, the equipment developed by Philip Morris engineers measures with great accuracy the dilution of cigarettes puffed by human smokers with the least

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possible interference with normal smoking behavior. While the cigarette must be encapsulated, the light glass holder used with the PPA is connected to the machine by flexible tubing and can be moved freely. Test subjects are thus able to assume a posture as close as possible to that of everyday, relaxed smoking.

Apparently the primary concern reflected in the Commission's question 5 is the question, raised several months ago by the Commission's staff, whether a sufficient length of cigarette filter extends from the end of the glass PPA holder to permit the smoker to hold the cigarette in his lips in his customary manner. The way that smokers hold and use cigarettes has been a matter of interest to Philip Morris for many years, and our continuing evaluations have led us to conclude that smokers do not typically insert more than about nine millimeters of a cigarette into their lips, which is safely less than the amount of filter extending from the end of the glass PPA holder. Rather than rely on that conclusion, however, we prepared cigarettes with extended bypass filters containing ventilation perforations 17 millimeters from the mouth-end of the filter, so that a full 15 to 16 millimeters could be made available for the smoker's lips. These extended

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bypass filter cigarettes have been used in internal Philip Morris testing, and were used, in addition to the commercially marketed Barclay cigarettes, with the more than 500 subjects in the large-scale U.S. Testing studies. These tests confirm that, no matter how much of the filter is available for the smoker's lips, the dilution of Barclay drops enormously.

In its October 23, 1981 submission, Brown & Williamson appears to argue that the PPA might give incorrect results because it prevents smokers from blocking the ventilation perforations of cigarettes with their fingers. We fail to understand, and B&W has not explained, how the necessary encapsulation of the ventilation perforations of Barclay and of all other cigarettes tested on the PPA in any way affected the uniform results -- i.e., that Barclay's dilution always dropped significantly when puffed in the lips but not when puffed in the mouthpiece, and that the same phenomenon did not occur for any other brand.

In any event, in our experience, the blockage of ventilation perforations by smokers is rare. Cigarettes are normally and comfortably held near their center of gravity, which is far from the ventilation perforations of any cigarette. Moreover, many smokers

remove their fingers entirely from the cigarette during puffing, and it would be especially awkward and uncomfortable to hold one's fingers over the perforations during a puff.

Even if one were to assume that a greater amount of hole-blockage occurs in normal smoking, it merits emphasis that the hole-blockage issue is altogether different from the issue raised by the bypass filter. It is not the smoker, but the manufacturer, that causes Barclay to deliver far more "tar" than other products measuring 1 mg. by current FTC method. An educated smoker of another brand may easily avoid interfering with the filter's ventilation, but the smoker of Barclay, through no misuse of his own, smokes a cigarette that has a substantially lower dilution in his lips than it has on the current FTC machine.

Indeed, it is ironic that Brown & Williamson appears to subscribe to the hole-blockage thesis, because of all cigarettes on the market, Barclay would be the most dramatically affected by that kind of misuse. Barclay employs an extremely low efficiency filter, and the four peripheral grooves draw dilution air through only a fraction of the perforations in the tipping paper. Accordingly, wholly apart from the occlusion caused

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by the smoker's lips, blockage of only a very few of Barclay's ventilation perforations would result in an enormous increase in "tar" delivery.

6. "To what extent did the data for each subject tested vary? Does the raw data for each subject still exist? Can it be made available to the Commission staff?"

Smokers are not machines, and all smokers' puffs vary somewhat from puff to puff. Nonetheless, the Puff Parameter Analyzer has tended to show remarkably consistent results for each given smoker. In particular, Barclay's dilution appears to drop substantially on every puff.

All data developed in both the original Philip Morris study and the large-scale U.S. Testing studies have been retained, and will be made available to the Commission upon request.

7. "What cigarette did each subject tested customarily smoke? If they smoked a cigarette during the air dilution test different from their customary cigarette, what impact, if any, did this fact have on the results? Was each subject tested also tested on their customary cigarette? If not, why not?"

The participants in the original Philip Morris study were smokers of a variety of cigarettes.

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Identification of the specific brands will be made available to the Commission upon request. The customary cigarettes of smokers were not included in the original Philip Morris dilution study.

It should be noted that most dilution measurements have been made by having smokers puff unlit cigarettes. One reason for this was to minimize any possible distortion that might occur in a smoker's puffing pattern by exposing him to a cigarette with smoke characteristics different from those of his customary brand. For example, because Barclay delivers many times more "tar" than 1 mg. cigarettes such as Carlton or Cambridge, it was feared that a Carlton or Cambridge smoker might not feel comfortable taking his regular puff on a lit cigarette such as Barclay.

In the large-scale study conducted by U.S. Testing, the regular brands of test subjects were in accordance with the demographics of the smoking population generally. The customary brand of each test subject was noted, and every subject was tested with his regular brand. As noted above, over 100 of the test subjects in the large-scale U.S. Testing study were tested with lit as well as unlit cigarettes. The measurements on lit cigarettes indicated the same

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dramatic drop in the dilution of Barclay when smoked in the lips.

II. BROWN & WILLIAMSON'S COTININE EXPERIMENT DOES NOT SUPPORT ITS POSITION THAT BARCLAY'S "TAR" DELIVERY IS THE SAME AS THAT OF OTHER BRANDS MEASURED AT 1 MG. "BY FTC METHOD."

Brown & Williamson has been unable to refute the overwhelming evidence presented in the dilution studies. Instead, B&W relies primarily on the theory that valid conclusions about the "tar" deliveries of specific cigarette brands can be drawn from an analysis of smokers' bodily fluids, in particular, measurement of plasma cotinine.

On its face, this theory is flatly inconsistent with the entire philosophy of smoking machine testing that has informed the Commission's "tar" and nicotine determinations for many years. The Commission has sought to measure all cigarettes on a standardized machine, with standardized characteristics and smoking parameters, to avoid variations and distortions introduced by human physiology and individual behavior. The simple change in the standardized holding device proposed by Philip Morris will close the loophole now being exploited by B&W and will restore comparability of results to the testing program.

Nevertheless, since the Commission invited comments on B&W's cotinine presentation, we have undertaken an analysis of that presentation, with the assistance of three of the most prominent experts in this area of research, Dr. Herbert McKennis of the University of Miami, Dr. Paul Larson of the Medical College of Virginia, and Dr. Neal Castagnoli of the University of California. These scientists, whose comments are submitted herewith as Exhibits 1-3, lead us to conclude that the experiment advanced by B&W is scientifically unsound.

A. B&W's Cotinine Experiment Is <u>Scientifically Unsound.</u>

The flaws in Brown & Williamson's presentation -- are numerous and fundamental.

Brown & Williamson's arguments are predicated upon an unreasonably simplistic view of nicotine and its metabolism. B&W's thesis proceeds from the assumptions that (i) "[c]otinine is the <u>first</u> and primary metabolic product of nicotine;"[9/] (ii) all nicotine in smoke is absorbed into the lungs; (iii) exactly 70%

9/ Submission to the Federal Trade Commission on behalf of Brown & Williamson Tobacco Corporation at 35 (October 23, 1981) (emphasis in original).

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of that nicotine turns promptly into cotinine; and (iv) all cotinine distributes itself evenly throughout the body and disappears with a half-life of 30 hours. Each and every one of these assumptions is unsupportable and flows from a drastic oversimplification of the extraordinarily complex and only partly understood _in vivo_ metabolism of nicotine.

First, much has been written in the scientific literature about cotinine, and there are substantial uncertainties on many issues; but one point on which there has always appeared to be consensus is that cotinine is _not_ the first metabolic product of nicotine.

Second, not all nicotine in cigarette smoke is absorbed into the lungs. Some smokers inhale more deeply or longer than others, which would lead to greater absorption. Even for a given smoker, the degree of absorption may vary with the nicotine composition of the smoke and other factors.

Third, not all nicotine is metabolized, nor is the fraction a constant 70%. Some nicotine is excreted directly in the urine, the exact proportion depending on a number of biological and physiological factors which vary from subject to subject and are not

always constant even in a single individual. In particular, low urine pH will invariably lead to considerably greater nicotine excretion and concomitantly lower metabolization.

Moreover, not all metabolized nicotine turns into cotinine. The primary metabolites of nicotine are believed to be nicotine 1'-N-oxide, 5'-hydroxynicotine, isomethylnicotinium ion, and perhaps nornicotine. It is generally believed that 5'-hydroxynicotine then forms cotinine, as well as nicotine Δ 1'(5')-iminium ion and γ-(3-pyridyl)-γ- methylaminobutyric acid, the latter of which is believed to reach equilibrium with cotinine. Cotinine transforms into a number of further metabolites including cotinine methonium ion, cotinine N-oxide, hydroxycotinine, and γ-(3-pyridyl)-γ-oxo-N-methylbutyramide, some of which are metabolized further.

<u>Fourth</u>, B&W's facile assertion that cotinine is a "small lipid molecule" and therefore may be assumed to distribute itself evenly throughout the body lacks scientific demonstration. On the contrary, researchers have concluded that nicotine and its metabolites concentrate in various proportions in different parts of the body.

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Accordingly, in the real world, the degree of formation of cotinine or any other nicotine metabolite varies from person to person, and probably varies for a given person with dietary, environmental, and physiological factors. In particular, the pharmacokinetics of nicotine appear to depend substantially upon dose. At high doses of nicotine, a greater proportion is excreted in the urine and a lower proportion of cotinine is formed.

Because of the complexity of nicotine metabolism and the absence of reliable dose-response information, there is serious question among scholars as to whether cotinine measurements have any validity for making comparisons among different cigarette brands. Even if one were to assume that such studies could be conducted, however, the experiment performed by B&W contains substantial methodological problems.

For example, the gas chromatographic methods relied upon by Gori are not adequately specific; a number of compounds other than cotinine may give a chromatographic peak indistinguishable from that of cotinine unless mass spectrographic or other techniques are employed to discriminate among the compounds. In addition, Gori's failure to use an internal standard casts serious doubts

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on the validity of his results. Moreover, while the notion that every test subject serves as his own control may make sense in the abstract, it necessarily assumes that there are no changes in the diet, environment, or stress levels of the subjects. Such assumptions are highly questionable and have not been justified.

In view of the lack of rigor in Gori's methodology, it is not surprising that some bizarre data have been generated. For example, according to Table 4 in the Darby and McNamee paper, Gori's test subject No. 28 had a plasma cotinine level of 223 mg./ml. prior to switching from Barclay to Cambridge cigarettes. After smoking 52 Cambridge cigarettes a day for three days, his plasma cotinine level dropped to 42 mg./ml. Given the 30-hour cotinine half-life assumed by B&W, that subject's plasma cotinine level three days after switching from Barclay should have been higher than 42 mg./ml. even if he did no smoking at all. In short, B&W's data suggest that smoking Cambridge cigarettes removes cotinine from a smoker's blood.[10/]

10/ It should also be noted that the statistical treatment of Gori's data appears highly dubious. For no apparent reason, the data points for Gori's first panel were assumed to fall into a "normal" distribution, and the data points for the second panel were assumed to fall into a "lognormal" distribution. There was also
[Footnote continued on following page]

For all of these reasons, and the reasons elaborated in the attached comments of Drs. McKennis, Larson and Castagnoli, B&W's cotinine data are scientifically invalid and unsound. B&W's cotinine experiment does not refute the clear evidence of the duplicitous operation of the Barclay filter demonstrated by the Philip Morris and U.S. Testing dilution studies, and confirmed by other substantial evidence presented to the Commission.

B. The Data Underlying the B&W Experiment Confirm the Results of the Dilution Studies Showing that Barclay's "Tar" Delivery Substantially Exceeds That of 1 mg. "Tar" Cigarettes by FTC Method.

As discussed above, the cotinine experiment proffered by Brown & Williamson is without scientific value. Even if one were to assume that B&W's data had some validity, however, they would not support B&W's claims regarding Barclay. Indeed, the data generated

[Footnote continued]
a huge variation in the data for each brand: Using Gori's "standard errors" (we assume Gori meant standard deviations), it appears that all of the means overlap within two standard deviations, and two or three individual standard deviations often exceed the individual means. It is extremely unlikely that statistically significant conclusions can be drawn from such data.

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in B&W's experiment actually suggest that Barclay delivers substantially higher "tar" than brands, such as Cambridge or Carlton, which deliver 1 mg. "tar" by FTC method.

It should be noted that the graphs attached to the Darby and McNamee paper submitted by B&W only show predicted plasma cotinine levels for Gori's subjects. B&W did not attempt to fit Darby and McNamee's model to the actual data obtained by Gori. We have done that for them.

Attached hereto as Exhibits 4-7 are graphs applying the Darby and McNamee model to actual data obtained by Gori. As these exhibits make clear, there is a huge increase in the plasma cotinine levels of the subjects' blood when they switch from Cambridge or Carlton to Barclay, frequently 100% to 200% or more. B&W attempts to explain away this phenomenon by claiming that Barclay cigarettes, tested under standard FTC machine conditions, have the same "tar" delivery as Cambridge or Carlton -- 1 mg. -- but twice the nicotine delivery -- 0.2 mg. for Barclay, as compared with 0.1 mg. for Cambridge and Carlton. On this premise, B&W asserts that if Barclay, Cambridge and Carlton in fact deliver the same level of "tar," cotinine analysis of

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Barclay should indicate twice the nicotine delivery of the other brands.

Brown & Williamson appears to have indulged, however, in some convenient rounding. According to the Commission's official report of December 15, 1981, the nicotine delivery of Barclay under machine smoking conditions is 0.15 mg.; the nicotine delivery of Cambridge and Carlton under identical machine smoking conditions is 0.11 mg. In short, under machine conditions, Barclay does not deliver twice the nicotine of Cambridge or Carlton, as B&W has asserted; instead, Barclay is at most 36% higher in nicotine. If Barclay was in fact the 75% dilution-1 mg. "tar" cigarette B&W claims it to be, then forced switching from Cambridge or Carlton to Barclay could increase the plasma cotinine level by no more than 36%. Gori has demonstrated, however, that the increase in plasma cotinine level is far greater than that.[11/]

Because of behavioral and pharmacokinetic factors frequently discussed in the literature, if Barclay

11/ With respect to Now cigarettes, B&W's "rounding" may have gone even further. The December 15, 1981 Commission report lists Now's nicotine delivery by FTC method as 0.22 mg., but B&W's papers claim that Now's nominal nicotine delivery is 0.1 mg.

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produces a plasma cotinine level 100 to 200 percent higher than that of Cambridge or Carlton -- as reflected in the data presented by B&W -- one can reasonably infer that, under equivalent machine smoking conditions, Barclay would deliver far more than 200 percent more "tar" than Cambridge or Carlton. Gori made the point himself in the B&W submission:

> "First, it is necessary to realize that smokers vary in their appetite or demand for smoke. In this situation a low yield cigarette is likely to be utilized more completely than high yield cigarettes. The analogy is that of offering water in pint and gallon containers to a group of thirsty people. Most pint containers are likely to be totally emptied, while many of the gallon containers will remain variously full. Thus in measuring uptake from different cigarettes, one can expect a greater variability of results with smokers of high yield cigarettes than otherwise. Also, the behavior and perhaps the smoke metabolism of smokers of high yield cigarettes is most likely different from that of low yield cigarette smokers. Because of this, the relationship of smoke residues in smokers of high yield cigarettes does not follow a one-to-one proportion, when matched to the nominal FTC yield of the cigarette smoked. For instance a smoker of a 10 milligram cigarette can not be expected to have 10 times the smoke residues in his system when compared to a smoker of a 1 milligram cigarette. Based on some available fragmentary evidence, he is likely to have less than a ten-fold increment, and the precise relationship can not be predetermined with accuracy at the

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present state of the art." Letter from Gio Batta Gori, D.Sc., MPH to Martin London, Esquire, at 4 (October 22, 1981).

Significantly, the smokers utilized in the Gori experiment were generally smokers of 1 mg. delivery cigarettes such as Carlton and Cambridge. Using Gori's reasoning, it is not surprising that when such smokers were forced to switch to an 8 mg. cigarette such as Barclay, their plasma cotinine levels did not go up eightfold, but only a few hundred percent.

The inescapable conclusion is that B&W's own data demonstrate that Barclay delivers substantially more "tar" than other brands ranked by the current FTC method at 1 mg.

CONCLUSION

The Commission's investigation of Barclay cigarettes has been pending since May 1981, and during that time extensive evidence has been submitted by most of the United States cigarette industry establishing the duplicitous character of the bypass filter. The large-scale demographic study conducted by U.S. Testing proves beyond any doubt that the dilution of Barclay cigarettes when smoked in the lips is far less than

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the dilution of Barclay cigarettes when puffed in a smoking machine. No other cigarette experiences any substantial drop in dilution. Barclay's dramatic drop in dilution necessarily results in a delivery of "tar," nicotine, carbon monoxide, and other smoke components that is substantially higher than that of other cigarettes with similar rankings by current FTC method. Brown & Williamson's own cotinine experiment, despite the dearth of scientific detail and the apparently endemic methodological errors, provides further evidence of the duplicitous character of the bypass filter.

The simple modification to the holding device in the Commission's smoking machine recommended by Philip Morris last year, and now supported by most of the industry, would readily and conveniently close the loophole in the Commission's testing procedure being exploited on a large scale by Brown & Williamson with Barclay, Kool Ultra and Viceroy Ultra Rich Lights. To maintain the integrity of the Commission's "tar" and nicotine rankings, and to assure consumers a fair basis for comparing cigarette brands, we urge that that modification be made forthwith.

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Exhibit 1

February 11, 1982

Hadrian R. Katz, Esquire
Arnold & Porter
1200 New Hampshire Avenue, N. W.
Washington, D. C. 20036

Dear Mr. Katz:

You have asked for my comments on a series of papers prepared by various authors on behalf of Brown & Williamson Tobacco Corporation, namely "Submission to the Federal Trade Commission on Behalf of Brown & Williamson Tobacco Corporation," a letter of October 22, 1981 from Dr. Gio Batta Gori of the Franklin Institute Policy Analysis Center to Martin London, Esquire, and "Use of Cotinine Blood Concentration as a Detection Method of Nicotine Delivery with Cigarette Smoking," by Dr. T. D. Darby and Dr. James E. McNamee of the University of South Carolina School of Medicine. In particular, you have asked whether the experiment described by Brown & Williamson involving measurements of plasma cotinine levels */ permits one to draw

*/ There is a certain inherent confusion in the Brown & Williamson papers caused by the authors' apparently interchangeable use of the words "blood" and "plasma." See for example pages 1, 4, 5, and 6 of the Darby and

[Footnote continued on following page.]

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conclusions about the relative smoke (nicotine) deliveries of particular brands of cigarettes.

My principal conclusions are two-fold:

First, in my professional judgment, as one who has been doing work in this area for over 20 years, the current state of the scientific art simply will not support Brown & Williamson's conclusions that plasma (blood) cotinine levels can serve alone to measure lung intake of nicotine from cigarettes. The process of nicotine metabolism is far too complex and includes too many only partially understood variables to permit meaningful comparisons of nicotine absorbed from various cigarette brands. Brown & Williamson is able to draw conclusions only by making a number of simplifying assumptions -- that all nicotine

[Footnote continued.] McNamee monograph. If we are to consider the Gori letter of October 22, 1981 as the prime source, we conclude that plasma would be intended throughout. Since samples of whole blood were available when obtained from the subjects of the Gori study, it is to be regretted that cotinine concentration of whole blood was not determined to make comparisons possible. It is well known that many substances tend to concentrate in the plasma and are carried or bound to plasma protein. Some authors (unpublished observations) consider that cotinine is bound to blood plasma protein and that this affects the long half-life of cotinine.

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comes from cigarettes, that of all nicotine in smoke that is absorbed into the lungs, 70% turns promptly into cotinine, and that all cotinine distributes itself evenly throughout the body and disappears with a half-life of 30 hours -- all of which appear to be unsound and unsupported on a general basis.

Second, while the paucity of experimental data and procedural details makes it difficult to comment at length upon the specific techniques employed by Gori, it appears that his methodology was poor. In particular, the failure to control a number of key variables such as the urinary pH of test subjects, and the rather simplistic manner in which gas-chromatographic analyses were conducted, leads me to be suspicious of the data generated in Gori's experiment.

In general, nicotine absorption in a smoker's lungs will vary from individual to individual, and probably in a nonlinear fashion for any given individual.*/

*/ I should note that it is partially speculation at this point in the development of the science to indicate where nicotine that arises in the human body had its source.

[Footnote continued on following page.]

The pH of the smoke and particle size of the intake are probably significant determinants of nicotine absorption. After the nicotine is absorbed, the timing and extent of its conversion to cotinine will also vary from individual to individual, and probably nonlinearly for any given person. Genetic, nutritional, age, and blood chemical factors are all significant in determining the metabolic route of the nicotine. In particular, urinary pH is a primary determinant of direct nicotine excretion; low urinary pH will lead to greater nicotine excretion and concomitantly low cotinine formation.

[Footnote continued.] Certainly tobacco is one principal source. Other possible sources include tomatoes (Dawson, Solt, and Christman, Ann. N.Y. Acad. Sci., 90, 7, 1960) peppers, and eggplant. Currently, there are some 400 species of tomato plants commercially available in the United States, and data on the nicotine content of most of these species is very scanty. The same can be said about data on a number of other plant sources, and people are just beginning to report the presence of cotinine in various types of plant material not closely related to tomatoes. The possibility of nicotine or cotinine being absorbed from sources other than cigarette smoke makes it extremely difficult to draw conclusions about cigarettes from experiments such as those performed by Brown & Williamson.

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The anonymous author of the Brown & Williamson Submission to the FTC states that cotinine is the "first and primary" metabolic product of nicotine. That is a serious misconception. Soon after my group first identified (McKennis, Turnbull, and Bowman, J. Amer. Chem. Soc. 79, 6342, 1957) cotinine as a metabolite of nicotine, Hucker, Gilette and Brody (Nature, 183, 47, 1959; J. Pharm. Exp. Therap., 129, 94, 1960) suggested that 5'-hydroxynicotine was an intermediate that preceded cotinine. Hence, it has been known for many years that cotinine itself cannot be the first metabolic product. It has also been noted that 5'-hydroxynicotine may be in equilibrium with 4-3-pyridyl-4-methylaminobutyric aldehyde. These substances themselves, as well as the corresponding methylamino acid, therefore may be precursors of cotinine. Later, Murphy (J. Biol. Chem. 248, 2796, 1973) proposed that nicotine Δ-1'(5')-iminium ion was an intermediate in the series of compounds which leads to the formation of cotinine. Since that time, numerous other authors have discussed this subject. Nicotine metabolism is a very complex process, and the

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Brown & Williamson papers are unscientific in their assertions to the contrary.

After cotinine is formed in the body, its persistence is likely to vary from individual to individual, and nonlinearly for any given person. Cotinine may tend to bind to proteins, but the degree of binding is likely to depend on the presence of other chemicals in the blood. Accordingly, rather extensive analyses of relevant chemicals in the blood would be necessary before drawing any conclusions from cotinine levels.

Some comment should perhaps be made regarding Gori's effort to have each test subject serve as his own control. While there is a certain abstract logic to that proposition, in practice it would be necessary to control diet, urinary pH, urine flow rate, stress, and many other factors for the individual test subjects to assure that no systematic errors were being built into the study. In particular, it is difficult to understand Gori's apparently complete indifference to the urinary pH of his subjects. As early as 1942, Haag and Larson (J. Pharmacol. Exptl. Ther. 76, 235,

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1942) noted the significance of this variable, and the same or similar studies have been repeated in many countries of the world.

Truhaut and DeClercq (Comt. Rend. 253, 1956, 1961) have presented evidence for the mammalian formation of dihydrometanicotine as a nicotine metabolite. We are not at this point aware of any evidence that dihydrometanicotine occurs as a result of the metabolism of nicotine in human urine, but that would appear to be a reasonable hypothesis. Some tobaccos are said to be high in metanicotine.

In man, cotinine can be metabolized to cotinine methonium ion (McKennis, Turnbull, and Bowman, J. Biol. Chem., 238, 719, 1963), and in the dog nicotine is subject to methylation of the nitrogen on the pyridine ring with the resultant urinary excretion of nicotine isomethonium ion. Nicotine metabolism in man frequently tends to parallel that in the dog, and therefore some investigation should be made into the possible excretion of nicotine isomethonium ion in man. Until such questions are answered, the methodology employed by Gori simply cannot be considered sound.

A number of the principal problems with the Brown & Williamson analysis can be illustrated by a detailed examination of Table 1 of the Darby and McNamee paper. The table is entitled "Factors Affecting the Determination," although it is not clear whether "determination" refers to the mathematical results which are based upon a number of shaky biological assumptions, or the determination experimentally of some of the factors important to the subject.

Item 1 in Table 1 is "Sensitivity and accuracy of the method used for determination of cotinine blood values," and it raises a serious question about the experimental laboratory work performed by Gori. There is simply no way of knowing in Gori's study whether the cotinine peaks in the gas-chromatographic determinations represent pure cotinine, or cotinine plus other compounds which may be present in the blood. Among the other compounds that may be, and frequently have been, mistaken for cotinine are other metabolites of nicotine. For instance, in a paper by Pilotti, Enzel, McKennis, Bowman, Dufva, and Holmstedt (Beitr. Tabakforsh. 8,339, 1976),

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it was noted in three different gas-chromatographic columns that allohydroxycotinine, one of the many pyridine metabolites of nicotine, appears with the same retention time as cotinine. In each instance where one is setting up gas-chromatographic determinations of cotinine, irrespective of the nominal composition of the column, it appears necessary to run numerous controls and determine whether or not the cotinine peak from biological material actually represents pure cotinine. This can be handled by use of mass spectrometry, infrared spectroscopy, paper chromatography, thin-layer chromatography, or the like. Gori's failure to include such controls precludes reliance upon his data.

Item 2 of Darby and McNamee's Table 1, "Cotinine biological half-time," and Item 9, "Conversion half-time for nicotine metabolism to cotinine," can perhaps be discussed together. Brown & Williamson assumes that precisely 70% of nicotine is converted to cotinine, essentially immediately, and that cotinine then has a half-life in the body of 30 hours. These assumptions appear to be completely arbitrary, and are inconsistent with a number of complications in nicotine metabolism.

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For example, Feyerabend (Workshop on Nicotine, Svenska Tobac. A.B., Stockholm, 1974) reported that following pulse injection of nicotine intravenously over a period of 10 minutes, nicotine concentrations in saliva rose to a level of approximately 300 nanograms per milliliter, while the blood concentrations of nicotine never exceeded 25 nanograms per milliliter. As pointed out in a paper by Castro, Monji, Ali, Yi, Bowman, and McKennis (Eur. J. Biochem. 104, 331, 1980), this excretion of nicotine into the saliva leads to the possibility of reintroduction of nicotine by way of the gastrointestinal tract. Other sources for the reabsorption of nicotine including the buccal cavity itself need to be considered.*/

*/ In light of the saliva data and related studies, it is surprising that Darby and McNamee state (page 4, lines 13 and 14) that cotinine, being a small lipid molecule, distributes within all tissues in a volume equal to the total body water content. Such a sweeping and surprising generalization would require considerable experimental support. If one is to call cotinine a small lipid molecule -- and the dictionary will permit this -- one could equally well call benzene and related compounds small lipid molecules, and the latter certainly do not distribute themselves as Darby and McNamee suggest. Although there are limited amounts of data on the distribution of cotinine in various tissues which probably could be improved with modern analytical methods, the problem seems to lack solution at this point.

That nicotine can be converted to nicotine 1'-N-oxide is another factor that must be considered in drawing conclusions about nicotine metabolism to cotinine. Once nicotine 1'-N-oxide has been formed in man, it can undergo a number of different metabolic routes including reconversion to nicotine and possibly conversion to cotinine N-oxide which has been described as a mammalian metabolite of nicotine by Dagne and Castagnoli (J. Med. Chem., 15, 840, 1970). It can be noted in passing that if cotinine N-oxide is injected into a gas-chromatographic apparatus under conditions resembling those described in the Gori study, there will likely be conversion of cotinine N-oxide to cotinine and this will lead to an abnormally high level of apparent cotinine in plasma. This factor appears to have escaped the attention of the Brown & Williamson authors.

Another source of possible influence of nicotine 1'-N-oxide may be found in the paper of Kline and Gorrod (Eur. J. Drug Metab. and Pharamacokinetics, 51, 1978). In Table 1 of that study, it was noted that 8 of the 47 male subjects excreted (on a weight basis) more nicotine

1'-N-oxide than cotinine in the urine during the 24 hours after smoking tobacco-containing cigarettes. The same was true of at least 5 of the female subjects in that study, and in one case, excretion of nicotine 1'-N-oxide was more than twice that of cotinine.

Items 3, 4, and 5 of Darby and McNamee's Table 1, "Number of cigarettes smoked per day," "Variation in daily cigarette smoking pattern," and "Inhalation pattern of the individual smokers used in the study," include footnotes stating that the items can be minimized or corrected on the basis of alveolar carbon monoxide data. That may well be true in theory, but it is essentially impossible in practice. People have been struggling for at least 20 years to justify the use of carboxyhemoglobin or alveolar carbon monoxide levels to determine those very things. Despite many attempts at justification and many attempts at verification, this procedure still appears to be shaky. It remains a fact that being caught in a traffic jam can affect carbon monoxide levels as much, or more, than cigarette smoking.

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Item 7 of Darby and McNamee's Table 1 notes body weight and surface area variations among the subjects in the experiment. If those facts are known to affect the results, as appears likely, Brown & Williamson's papers would appear to require some discussion and interpretation in those areas.

Item 8 of Darby and McNamee's Table 1 concerned the sex of the subjects. The two groups in the experiment directed by Gori included both female and male subjects, and Gori noted that the subjects were healthy. Since pregnancy is not a disease state, one should note the experiments of Kline and Gorrod (Eur. J. Drug Metab. and Pharmacokinetics, 87, 1978) where it was noted that the urinary excretion ratio for cotinine to nicotine 1'-N-oxide in the 24-hour period was 6.56. This figure was almost four times that obtained in a control group of nonpregnant females. While the pregnant subject group was rather small, the published data point to another important gap in the Gori data reports.

All in all, very little has been done in man to permit one to assign a general figure for the conversion

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of nicotine to cotinine following cigarette smoking. It is dangerous to conclude from serum cotinine values that a given amount of nicotine has been absorbed through the lungs of a given subject. It is even more dangerous to purport to be able to draw conclusions from such values about the relative performance of different brands of cigarettes under uniform smoking conditions. The day may come that experiments on human subjects such as those performed by Gori will provide useful information about specific cigarettes. The current level of science, however, does not yet permit this -- even in studies performed with substantially more care and precision than that evidenced by Brown & Williamson.

Sincerely yours,

Herbert McKennis, Jr.

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1960- Visiting Professor, Institute of Physiology, University of Chile

1966-1967 Consultant, Surgeon General's Committee on Smoking and Health

1976-1978 Scientific Advisor to Governor, Commonwealth of Virginia

1973-1979 Head, Division of Biochemical Pharmacology, Medical College of Virginia

SELECTED AWARDS:

Honorary Member, Medical Faculty, University of Chile (Life)
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Meritorious Service Award, U.S. Navy Department
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Exhibit 2

Virginia Commonwealth University

Medical College of Virginia

February 2, 1982

Hadrian R. Katz, Esquire
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1200 New Hampshire Avenue, N.W.
Washington, D. C. 20036

Dear Mr. Katz:

As you requested, I have reviewed the October 22, 1981, letter from ~~Dr.~~ Gio Batta Gori of the Franklin Institute Policy Analysis Center, and the monograph by Drs. T. D. Darby and James E. McNamee of the University of South Carolina School of Medicine entitled, "Use of Cotinine Blood Concentration As A Detection Method of Nicotine Delivery With Cigarette Smoking." The study conducted by Dr. Gori and additionally interpreted by Drs. Darby and McNamee purports to draw conclusions about the nicotine delivery of cigarettes based on measurements of the cotinine level in a smoker's plasma at periods of time after switching to the cigarette brand in question. These papers present some rather novel and creative reasoning, but too often rest upon assumptions that do not appear to be supported by either the experimental data obtained in the study, or by previous scholarship. Some of the unresolved problems and questions, as I see them, follow:

Available data support the view that increases in nicotine dose will result in increases in production of its metabolite cotinine with resultant increases in plasma concentration of cotinine. But, the relationship between the two increases is not likely to be simple and further data are needed before confident interpretations can be made. Some reasons for this follow:

1. It has been shown that increase in nicotine dosage results in an increase in the urinary excretion of unchanged nicotine (1,2) as well as in the per cent of the dose excreted (1). Per cent increase is linear with dose in the dog (1) but predictive information is needed for man.

2. The level of urinary excretion of cotinine has been judged by some investigators to be a measure of degree of nicotine exposure (3,4). Interrelationship data between excreted cotinine and plasma levels are needed since plasma cotinine unlike excreted cotinine remains susceptible to biotransformation.

3. Cotinine undergoes biotransformation and the rate of this may increase with increasing concentration of cotinine in the body, but data as to degree are lacking, thus further complicating the use of plasma cotinine as a measure of nicotine dosage.

Studies have also been interpreted to show that smokers tend to self-titrate their nicotine dosage when switching from high-to-low and vice-versa nicotine delivery cigarettes (6,7). This factor is recognized by Dr. Gori, but the evidence for it is dismissed as "fragmentary," ... "and the precise relationship can not be predetermined at the present state of the art," and a prediction is offered that "a direct comparison of smokers of high and low yield cigarettes would probably require a large number of subjects in order to reach statistical significance, and it is likely to be difficult to interpret unless differences between cigarettes were very high." (See Page 4 of Dr. Gori's report.)

None-the-less, to hopefully circumvent the above problem, Study B was designed to include only subjects who customarily smoked cigarettes of 0.1 mg (sic) nominal nicotine delivery for the comparative change in plasma cotinine levels on switching to the Barclay 0.2 mg (sic) nominal nicotine delivery cigarettes. Let it be noted that this is still a two-fold difference and in the study referenced (6) above the problem became evident between cigarettes with a maximum three-fold difference in nominal nicotine delivery.

Concerning the report by Drs. Darby and McNamee, their analysis includes the assumption that a flat 70% of absorbed nicotine is eventually converted to cotinine. I have found no supporting data for this assumption and, indeed, it is unsupportable, since it has been shown that with increasing dose of nicotine an increasing per cent of the dose is excreted unchanged in the urine (1).

A search for data supporting a half-life of 30 hours for plasma cotinine in man has also been unrewarding. A number of articles containing this statement have been found, but where referenced it has been to other articles including the same statement without revealing supporting data. All lower animal data indicate shorter half-lives for cotinine. Data for man is needed. Also needed is recognition that cotinine also undergoes biotransformation (5) and "... average renal function and normal urinary output ..." are not the sole criteria for elimination of cotinine from the body.

In summary, the Gori and Darby and McNamee papers evidence unsupported assumptions as well as omissions of consideration of available knowledge critical to interpretation of findings. I do not consider it possible to draw any conclusions from these papers about the relative characteristics of the specific brands of cigarettes studied.

Sincerely yours,

Paul S. Larson

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Paul Stanley Larson

Curriculum Vita

Personal Information:

Born:

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Home address:

Office address: 427 McGuire Hall; Phone 770-4694.

Wife:

Children:

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Education:

University of California (Berkeley), Ph.D. 1934 (Physiology).

University of California (Berkeley), A.B., 1930 (Chemistry).

Academic Appointments:

Haag Professor & Chairman, Dept. Pharmacology, MCV,	1963 - 1972.
Professor & Chairman, " " " ,	1955 - 1972.
Research Professor " " " ,	1950 - 1955.
Research Assoc. Prof. " " " ,	1946 - 1950.
Research Associate " " " ,	1941 - 1946.
Lecturer, Dept. Pharmacol., Wayne Univ., Sch. Med.,	1940 - 1941.
Associate, Dept. Physiology, MCV,	1939 - 1940.
Instructor, Dept. Physiology, Georgetown Univ. Sch. Med.	1934 - 1939.

Membership in Scientific Societies:

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Membership in Community Organizations:

St. Edward's Church.
Commonwealth Club.
Junior Clinical Club (Alumnus; Past President).
Caduceus Club (Past President).

National & International Listings:

American Men of Science.
Who's Who in America.
World Who's Who in Science.
Who Knows - and What.

Major Committees:

AIBS Advisory Committee to the AEC on Irradiation Substerilization of Food, 1962-65.
Drug Research Board, National Academy of Science, 1963-67.
Committee on Application of Biochemical Studies in Evaluating Drug Toxicity, National Academy of Sciences, 1965-67.
Subcommittee on Continuation Education, Drug Research Board, National Academy of Science, 1965-67.
Policy Advisory Committee, Drug Efficacy Study, National Academy of Science, 1966-67.
Program Study Panel, National Environmental Health Sciences Center, Research Triangle, N.C., 1965.
NIH, Toxicology Study Section, 1964-68.
AMA-ERF, Committee for Research on Tobacco and Health, 1964 - 1977.
NIH, AMA, CTR-USA, Subcommittee of the Joint Committee on Tobacco & Health, 1968 - 1972.
Research & Education Committee, McGuire Veterans Administration Hospital, 1964-70.
Endrin Advisory Committee, Food & Drug Administration, 1966-67.
Special Consultant to the Committee on International Exchange of Persons, 1966-68.
Editorial Board, Toxicology & Applied Pharmacology, 1959-1964.

Other Experience:

Pharmacologist, Frederick Stearns & Co., Detroit, 1940-41.
Principal advisor to six Ph.D. candidates and one M.S. candidate.

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Paul S. Larson

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2. The effect of insulin on the purine metabolism of the Dalmation coach-dog.
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11. The effect of diuresis on the excretion of glucose by the normal dog during constant glucose infusion.
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22. Studies on the fate of nicotine in the body. II. On the fate of nicotine in the dog.
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Silvette, H., Larson, P. S. and Haag, H. B.
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Exhibit 3

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1200 New Hampshire Avenue, N.W.
Washington D.C. 20036

Dear Mr. Katz:

I have studied the documents you sent to me concerning the continine studies performed by Dr. G.B. Gori and the pharmacokinetic model studies by Drs. T.D. Darby and J.E. McNamee. I also have discussed these studies with colleagues who are familiar with research in these areas. In the comments that follow, I will attempt to summarize the overall scientific merit of these two studies. Although there are aspects of these studies which have merit, on balance, I am not convinced that based on these studies one can conclude that Barclay's tar delivery is equal to that of other cigarettes with FTC testing measurements of one milligram.

It is well established that the tobacco alkaloid nicotine is rapidly metabolized in mammals including man. A variety of metabolites have been characterized both in vitro and in vivo. The most prominent metabolic pathway for nicotine in mammals is its conversion to the lacatam cotinine. This process occurs in two stages and involves the production of an intermediate carbinolamine followed by a second oxidation to cotinine itself. Cotinine is further metabolized to cotinine-N-oxide and trans-3'-hydroxycotinine. Analytical procedures for cotinine that require thermolysis (e.g. GLC) should take into account the possibility that a given biological sample may contain varying quantities of cotinine-N-oxide which may undergo thermal reduction to cotinine and thus lead to a false estimate of cotinine levels.

The nitrogen-phosphorous GLC detector used by Gori should provide adequate sensitivity for the estimation of human plasma cotinine levels. However, it is difficult to assess the accuracy of the data generated in these studies because of the scarcity of methodological details. Furthermore, since Dr. Gori did not employ an internal standard in his assay, the recovery data are likely to be very unreliable. Cotinine is extracted from plasma into organic solvents only with difficulty and emulsions often cause significant changes in extraction efficiency. Furthermore, water definitely is not a proper vehicle with which to perform recovery experiments. Consequently, plasma cotinine levels determined without the aid of an internal standard and based on poorly designed recovery data would at best provide only a crude estimate of the true values.

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I agree with Dr. Gori that, in theory, cotinine levels can provide a reasonable estimate of nicotine exposure. There are, however, a number of problems associated with the quantitative estimation of cotinine in plasma which have not been fully addressed by the Gori study. Confidence in the results will be particularly dependent upon an established dose versus plasma level correlation. Dr. Gori raises this issue himself on page 4 of his report when he states that "the relationship of smoke residues in smokers of high yield cigarettes does not follow a 1:1 proportion, when matched to the nominal FTC yield of the cigarette smoked." In the absence of such an experimentally determined correlation, the accuracy of the estimated nicotine exposures, when based on cotinine blood levels, will be questionable.

Finally, I am somewhat disturbed by the tacit assumption that nicotine and tar levels as determined by a standard machine test can be correlated with cotinine blood levels. In my opinion extensive "dose-response" studies would have to be conducted to justify any conclusions which assume such a relationship.

The pharmacokinetic model proposed by Darby and McNamee is reasonable to the extent that the long half-life of cotinine and short half-life of nicotine allow, in theory, one to calculate approximate nicotine exposure levels based on cotinine plasma levels. However, the practical value of the model will clearly depend on the accuracy of the parameters used in its design and application. The model should be tested with a wider range of experimental data in order to properly assess its utility and to establish the validity of the various assumptions used in its development. Although I must admit to a bias, in my opinion pharmacokinetic models of this type that are not thoroughly tested with experimentally derived data are of limited value.

Sincerely yours,

Neal Castagnoli

Neal Castagnoli, Ph.D.
Professor of Chemistry and
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Curriculum Vitae
CASTAGNOLI, Neal

Professor of Chemistry and
Pharmaceutical Chemistry.

Date of Birth. REDACTED

Place of Birth. Los Angeles, California.

PROFESSIONAL COMPETENCE.

EDUCATION. UNDERGRADUATE AND GRADUATE.

1964	Ph.D., Chemistry. University of California Berkeley, Ca.
1961	M.A., Endocrinology. University of California San Francisco, Ca.
1959	B.S., Chemistry. University of California Berkeley, Ca.

EDUCATION. POSTGRADUATE.

1965-1966	NIH Postdoctoral Fellow. Imperial College Department of Biochemistry London, England.
1964-1965	NIH Postdoctoral Fellow. Istituto Superiore di Sanita Rome, Italy.

SCHOLASTIC AND PROFESSIONAL HONORS/AWARDS.

Academic Senate, Distinguished Teaching Award, U.C.S.F., 1970-1971.

SPECIALTY/SUBSPECIALTY. Organic Chemistry.
Drug Metabolism.

POSITIONS HELD.

1976-	Professor, (on leave 09/80 - 09/81).
1973-1976	Associate Professor.
1967-1973	Assistant Professor.
	University of California School of Pharmacy Department of Pharmaceutical Chemistry San Francisco, Ca.
1980-1981	Special Assistant to Commissioner. Food and Drug Administration
	Department of Health, Education, and Welfare Public Health Administration Rockville, Md.

ADMINISTRATIVE APPOINTMENTS.

1977-	Vice-chairman, (on leave 09/80 to 09/81).
	University of California School of Pharmacy Department of Pharmaceutical Chemistry San Francisco, Ca.

MEMBERSHIPS IN SCIENTIFIC, PROFESSIONAL AND SCHOLARLY SOCIETIES.

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Curriculum Vitae
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PUBLICATIONS.

ORIGINAL ARTICLES.

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(56) The Tautomeric Structures of 5-Hydroxycotinine, a Secondary Mammalian Metabolite of Nicotine. T-L. Nguyen, E. Dagne, L. Gruenke, H. Bhargava, and N. Castagnoli, Jr.J. Org. Chem., 46, 758-760 (1981).

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(57) Regiospecific Attack of Nitrogen and Sulfur Nucleophiles on Quinones Derived from Poison Ivy/Oak Catechols (Urushiols) and Analogs as Models of Urushiol-Protein Conjugate Formation. D. J. Liberato, V. S. Byrs, R. G. Dennick, and N. Castagnoli, Jr. J. Med. Chem., 24, 28 (1981).

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(62) Structure-Activity Relationships in a Series of 2,3,5-Substituted Derivatives of 1-Phenyl-2-aminopropane. Consideration of Distributional and Metabolic Properties. G. M. Anderson, P. Jacobs, A. T. Shulgin, P. A. Kollman, and N. Castagnoli, Jr. J. Med. Chem., (submitted, 1981).

(63) Ion Pair High-Performance Liquid Chromatographic Assay of 4-Aminopyridine in Serum. Y. Shinohara, R. D. Miller, and N. Castagnoli, Jr. J. Chromatogr., (submitted, 1981).

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CASTAC I, Neal
Faculty

TEACHING.

Courses Taught. 1980/1981.

ON LEAVE OF ABSENCE

Course Name	Shared With	Number	Units	Lecture	Laboratory	Seminar Conference	Clerkship	F	W	S	SS	Hrs/Qtr*	Students	Lecturer	Lab Instructor	Conference Leader	Coordinator	Preceptor	

*Individual Contribution...Actual Contact Hours (Teaching & Consultation but not Preparation Time).

Comments:

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Courses Taught. 1981/1982

Course Name	Shared With	Number	Units	Lecture	Laboratory	Seminar Conference	Clerkship	F	W	S	SS	Hrs/Qtr*	Students	Lecturer	Lab Instructor	Conference Leader	Coordinator	Preceptor	
Chemistry	Full Responsibility	113	5	x		x		x				10	100	x		x			
Pharm.Chem.	" "	250	6-8	x		x		x	x	x	x	8	4	x		x			
Pharm.Chem./One time lecture	Staff	201	3	x				x					20	x					
Pharm.Chem.	Full Responsibility	203	2-3	x						x		30	20	x					

*Individual Contribution...Actual Contact Hours (Teaching & Consultation but not Preparation Time).

Comments:

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Curriculum Vitae
CASTAGNOLI, Jr., Neal

TEACHING. (Since Last Review).

DOCTORAL DISSERTATIONS COMPLETED UNDER CHAIRMANSHIP.

Armen Melikian, Ph.D., Pharm.Chem., Study of Compounds Related to Nicotine, 1970-1971.

S. B. Matin, Ph.D., Pharm.Chem., The Stereochemical Aspects of Centrally Active Compounds, 1971-1972 (Supervised in part).

Mark Cushman, Ph.D., Pharm.Chem., The Stereochemistry, Scope and Mechanism of the Condensation of Schiff Bases and Cyclic Anhydrides: Applications to the Synthesis fo Trans-3-Methylnicotine and Nirogen Analogs of the Tetrahydrocannabinols, 1972-1973.

Ermias Dagne, Ph.D., Pharm.Chem., Biotransformation Studies on S-(-)-Cotinine, 1972-1973.

Patrick Callery, Ph.D., Pharm.Chem., Studies on the Metabolism of the Psychomimetic Amine 1-(2,5- Dimethoxy-4-Meethylphenyl)-2-Aminopropane, 1973.

Jonathan S. Zweig, Ph.D., Pharm. Chem., Studies on the Metabolic O-Demethylation of the Psychotomimetic Compound 1-(2,5-Dimethoxy -4-Methylphenyl)-2-Aminopropane, 1974.

Matthew M. Ames, Ph.D., Pharm.Chem., Applications of Chemical Ionization Mass Spectrometry to In Vitro and In Vivo Metabolic Studies on R, S, and RS Alpha-Methyldopa (^{12}C and ^{13}C-Enriched), 1975.

Nguyen Thi Trong-Lang, Ph.D., Pharm. Chem., Alpha-Carbon Hydroxylation in the Metabolism of Tobacco Alkaloids, 1977.

N. Peter McGraw, Ph.D., Pharm. Chem., Spectral and Kinetic Metabolic Studies on the Interaction of 1-(2,5-Dimethoxy-4-methylphenyl)-2-aminopropane and its N-Hydroxy Metabolite with Rabbit Liver Microsomal Preparations, 1977.

D. R. Musson, Ph.D., Pharm. Chem., Chemical and Biological Studies on 3-(2,4,5-Trihydroxyphenyl)-2- Methylalanine (6-Hydroxy-cx-Methyldopa), 1979.

Bert Ho, Ph.D., Pharm. Chem., Cyanide Trapping of Metabolically Generated Electrophilic Intermediates Derived from Tertiary Amines, 1980.

Roger Cockerline, Ph.D., Pharm. Chem., Metabolism and Hypotensive Activity of (S)-cx-Methyldopa and its Amine Metaolites in Rat Brain Regions, 1980.

Lawrence K. Low, Ph.D., Pharm.Chem., Synthesis of Nitrogen Analogs of Tetrahydrocannibol and Cannabidiol: Potential Therapeutic Agents, 1980.

Alice Cheng, Ph.D. Pharm.Chem., Structure Analogs of Catecholamine with Neurotoxic Potential, 1981.

Dan Liberato, Ph.D., Pharm.Chem., Studies on the Molecular Basis of Poison Oak/Ivy (Urushiol) Immunogenicity, 1981.

DOCTORAL DISSERTATION COMMITTEES SERVED ON.

Member, Ph.D. Dissertation Committee, Alice Chui-Ling Cheng, Pharm. Chem., U.C.S.F., October 1981.

Member, Ph.D. Dissertation Committee, Bernie Silber, Pharm. Chem., U.C.S.F., August 1981.

Member, Ph.D. Dissertation Committee, Janine Estelle Rose, Pharm. Chem., U.C.S.F., July 1981.

Member, Ph.D. Dissertation Committee, Jeffrey Mark Blaney, Pharm. Chem., U.C.S.F., June 1981.

Member, Ph.D. Dissertation Committee, Bernie Silber, Pharm. Chem., U.C.S.F., June 1980.

Member, Ph.D. Dissertation Committee, Robert A. Baughman, Jr., Pharm. Chem., U.C.S.F., May 1981.

Member, Ph.D. Dissertation Committee, James Madison Mathews, Pharm. Chem., U.C.S.F., April 1980.

Member, Ph.D. Dissertation Committee, Kent Luvern Kunze, Pharm. Chem., U.C.S.F., April 1980.

Member, Ph.D. Dissertation Committee, Sidney Koon Woo, Pharm. Chem., U.C.S.F., October 1979.

Member, Ph.D. Dissertation Committee, Bruce Alan Mico, Pharm. Chem., U.C.S.F., June 1979.

Member, Ph.D. Dissertation Committee, Kathryn Susan Prickett, Pharm. Chem., U.C.S.F., March 1979.

Member, Ph.D. Dissertation Committee, James David Adams, Jr., Pharm. Chem., U.C.S.F., January 1979.

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COMMITTEE FOR ADMISSION TO PH.D. QUALIFYING EXAMINATIONS.

Member, Admission to Ph.D. Qualifying Examinations Committee, Jonathan Maybaum, Pharmaceutical Chemistry, U.C.S.F., June 23, 1978.

MASTERS EXAMINATION AND THESIS COMMITTEES.

Chairman, Master's Examination Committee, Toni Kline, Pharmaceutical Chemistry, U.C.S.F., 1977.

COMMITTEE FOR ADVANCEMENT TO CANDIDACY FOR DEGREE OF DOCTOR OF PHILOSOPHY.

Member, Committee for Advancement to Candidacy for Degree of Doctor of Philosophy, Donna Jeanne Bennett, U.C.S.F., January 24, 1978.

PROFESSIONAL RESEARCH PERSONNEL, POSTGRADUATE PERSONNEL, AND POSTDOCTORAL FELLOWS SUPERVISED.

M. Solomon, Ph.D., 1968-1969 (in the absence of J.C. Craig).

M. Bergenthal, Ph.D., 1968-1969 (in the absence of J. C. Craig).

K. Walker, Ph.D., 1968-1969 (in the absence of J. C. Craig).

P. Mulligan, Ph.D., 1968-1969 (in the absence of J. C. Craig).

Kent S. Marshall, Ph.D., 1970-1973.

Philip Walson, M.D., 1971-1973.

Larry Gruenke, Ph.D., 1972-1974 (With J.C. Craig).

Ashir Kalir, Ph.D., 1973-1974.

Joseph Gal, Ph.D., 1973-1975.

Jon Bordner, Ph.D.,

Metabolic Formation of Reactive Intermediates, U.C.S.F., 1975-1976.

Curt Freed, M.D., α-Methyldopa Metabolism, U.C.S.F., 1975-1976.

Leif Svensson, Ph.D., Metabolic Formation of Reactive

Intermediates, U.C.S.F., 1975-1976.

Charles Chavdarian, Ph.D., Mechanism of Action of Psychotomimetic Amines, U.C.S.F., 1975-1978.

Peyton Jacob, Ph.D., Metabolism of Psychotomimetic 1-Phenyl-2-aminopropanes, U.C.S.F., 1975-1978.

Daiji Karashima, M.D., Central Metabolism of α-Methyldopa, 1976-1978.

Russell Hillard, Ph.D., Drug Metabolism Studies, U.C.S.F., 1978-1979.

Lyall Williams, Ph.D., Metabolism of Psychotomimetic 1-Phenyl-2-aminopropanes, U.C.S.F., 1978-1979.

Rene Ziegler, Ph.D., Trapping Metabolic Intermediates, U.C.S.F., 1978-1979.

Marcel de Ruyter, Ph.D., Bioanalytical Studies, U.C.S.F., 1978-1980.

Salah A. Zahr, Ph.D., Computation of B-Adrenergic Agonists, U.C.S.F., 1978-1980.

Reg Ennick, Ph.D., Poison Oak/Ivy Urushiol Studies, U.c.S.F., 1979-.

Masanobu Horie, Ph.D., The Effect of Psychotomimetic Amines on Brain Biogenic Amines, U.C.S.F., 1979-.

Frans Compernolle, Ph.D., Metabolism of Tertiary Amines to Chemically Reactive Species, U.C.S.F., 1979-1980.

Yoshihiko Shinohara, Ph.D., Metabolic Studies on 4-Aminopyridine, U.C.S.F., 1980-.

Alexander Probst, Ph.D., Metabolism of Tertiary Amines, U.C.S.F., 1981-.

Asher Kalir, Ph.D., Professor of Medicinal Chemistry, Israel Institute for Biological Research, 1981-.

Yael Asscher, Ph.D., Metabolic Studies on Conjugates, U.C.S.F., 1981-.

Hiroshi Taniguchi, Ph.D., Assistant Professor of Chemistry, Meiji College of Pharmacy, Tokyo, Japan, 1981-.

GRADUATE STUDENTS SUPERVISED - RESEARCH.

Alice Cheng, Pharm. Chem., U.C.S.F., 1977-1978.

Roger Cockerline, Pharm. Chem., U.C.S.F., 1976-1978.

Bert Ho, Pharm. Chem., U.C.S.F., 1976-1978.

Dan Liberato, Pharm. Chem., U.C.S.F., 1977-1978.

Lawrence Low, Pharm. Chem., U.C.S.F., 1976-1978.

Peter McGraw, Pharm. Chem., U.C.S.F., 1976-1978.

Donald Musson, Pharm. Chem., U.C.S.F., 1976-1978.

Lang Nguyen Thi, Pharm. Chem., U.C.S.F., 1976-1978.

Jeffrey Blaney, Pharm. Chem., U.C.S.F., 1981-.

Kathleen Maloney, Pharmaceutics, U.C.S.F., 1981-.

RESEARCH. (Since Last Review).

AWARDS. FELLOWSHIPS. EXTRA-MURAL GRANTS.

National Institutes of Health, AI14752, "Allergic Skin Disease Program Project," (W. L. Epstein, P.I.), $102,000/year ($20,000 assigned to N. Castagnoli) 1981-1984.

National Institutes of Health, HL26340, "Conjugated Vasoactive Agents as a New Class of Drugs," (K. L. Melmon, P.I.), $237,000/year ($700,00 total), 1980-1983.

National Institutes of Health, HL26340, "Conjugated Vasoactive Agents as a New Class of Drugs," (K. L. Melmon, P.I.), $237,000 ($700,00 total), 1980-1983.

National Institutes of Health, GM26691, "Pharmacokinetics/Pharmacodynamics Center," (L. Z. Benet, P.I.) $4,600, 1978-1983.

National Institutes of Health, General Medical Sciences, GM 16496, Clinical Pharmacology-Pharmacokinetics Program Project, "Studies on the Metabolism of Alpha-Methyldopa," $180,000, 1974-1979.

National Institutes of Health, Allergy and Immunology, AI 12947, "In Vitro Studies on Poison Oak Sensitivity in Humans," $190,000, 1977-1980.

United States Public Health Service, GM 23918,

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"Pharmacological Properties of Ketamine Enantiomorphs," $100,000, (Principle Investigator: A. J. Trevor. Co-investigators: N. Castagnoli, Jr. and W. Way.), 1978-1981.

National Institute of Mental Health, MH 21219, "Metabolic Studies on Psychotomimetic 1-Phenyl-2-aminopropanes," $100,000, 1975-1982.

University of California, Cancer Research Coordinating Committee, 78SF5, "Metabolic Conversion of Estrogens to Electrophylic Intermediates and the Trapping, Isolation and Structural Characterization of these Intermediates as Stable Covalently-linked Mononucleoside Adducts of DNA or Model Polynucleotides, $13,000, 1978-1979.

University of California, San Francisco, Academic Senate, "Trapping of Metabolically Generated Electrophylic Intermediates by Nucleophiles, $4,000, 1977-1979.

Smith, Kline & French, Unrestricted Research Grant, $15,000, 1977-.

SUMMARY OF CURRENT RESEARCH INTERESTS.

Research activities have been devoted primarily to the application of principles of small molecule chemistry to problems in biology, with emphasis on the molecular mechanisms of drug metabolism and pharmacologic processes.

A major research interest concerns the molecular mechanisms of cytochrome P-450 catalyzed oxidations and the identification of metabolic pathways that may contribute to the biological properties of small organic molecules.

UNIVERSITY AND PUBLIC SERVICE. (Since Last Review).

UNIVERSITY. COMMITTEES.

Member, Coordinating Committee on Graduate Affairs, Systemwide, 1977-.

Member, Chancellor's Task Force on Graduate Academic Long Range Enrollment Study, U.C.S.F., 1978-.

Member, Chancellor's Committee, 5 Year Review of Dr. Roger Boles' Stewardship as Chairman, of the Department of Otolaryncology, U.C.S.F., 1979-1980.

Member, Chancellor's Academic Planning Board, U.C.S.F., 1977-.

Chairman, Graduate Council, Academic Senate, U.C.S.F., 1977-.

Chairman and Member, Subcommittees of the Budget and Interdepartmental Relations Committee (now Committee on Academic Personnel), Academic Senate, U.C.S.F., 1977-.

Member, Coordinating Committee, Academic Senate, U.C.S.F., 1977-.

Member, Committee on Committees, Academic Senate, U.C.S.F., 1977-.

Member, Committee on Schedule and Space, U.C.S.F., 1981-1982.

Member, Task Force for Mass Spectrometry Move, School of Pharmacy, U.C.S.F., 1981.

Member, School of Pharmacy Shop, School of Pharmacy, Department of Pharmaceutical Chemistry, U.C.S.F., 1981.

Member, Search Committee for Assistant Professor, School of Pharmacy, Department of Pharmaceutical Chemistry, U.C.S.F., 1981.

Member, Seminar Committee, School of Pharmacy, Department of Pharmaceutical Chemistry, U.C.S.F., 1981-1982.

Member, Search Committee for Assistant Professorship at the University of North Caroline, Chapel Hill, N.C., School of Pharmacy, U.C.S.F., 1981. Department of Pharmaceutical Chemistry, 1977-1978.

Chairman, Seminar Committee, School of Pharmacy, Department of Pharmaceutical Chemistry, 1976-1978.

Member, Graduate Instruction and Research Committee, School of Pharmacy, Department of Pharmaceutical Chemistry, 1977-.

Member, Pathway Requirements, Committee on Medicinal Chemistry, School of Pharmacy, Department of Pharmaceutical Chemistry, 1977-.

PUBLIC SERVICE. EDUCATIONAL OR GOVERNMENTAL AGENCIES.

Special Assistant to Commissioner of Food and Drug Administration, Advising Commissioner on Scientific Matters, D.H.E.W., U.S.P.H.S., 1980-1981.

Member, three study sections and two site visits for Public Health Service (NIH and NIMH), 1980-1981.

Member, Review Panel on Agent Orange, Office of Technology Assessment, U.S. Congress, 1981.

Member, National Research Council Toxicology Information Program Committee, 1981.

Member Advisory Committee, Los Alamos Scientific Laboratory for Biomedical Applications of Stable Isotopes, 1981-.

Consultant, National Institutes of Health, Medicinal Chemistry Study Section B, 1977-1978.

Consultant, Food and Drug Administration, 1977-1978.

PROFESSIONAL ACTIVITIES. (Since Last Review).

INVITED LECTURES/SEMINARS.

Invited Lecturer, University of Tripoli, Libya, April 1977. Presented short course on "Drug Metabolism."

Invited Lecturer, Kurume University, Special Lectures and Joint Lecture of Pharmacological and Biomedical Research by the Use of New Analytical Techniques, Kurume, Japan, September 12, 1977. "Applications of Stable Isotopes and Chemical Ionization Mass Spectrometric Analyses to Stereochemical Analyses to Stereochemical Problems in Drug Metabolism."

Invited Lecturer, University of Colorado, School of Medicine, Department of Pharmacology, Denver, Colo., November 14, 1977. "Aliphatic Amine Metabolism."

Invited Lecturer, American Organization of Analytical Chemistry, Annual Meeting, Atlanta, Ga., May 1, 1978. "Advances in Instrumentation for Analytical Methodology Development."

Invited Lecturer, University of the Pacific, Departments of Chemistry and Medicinal Chemistry, Stockton, Ca., May 23, 1978. "Metabolic Formation of Chemically Reactive Species."

Invited Lecturer, A. H. Robins Co., Richmond, Vir., June 1, 1978. "Metabolic Formation of Chemically Reactive Species."

Invited Lecturer, American Chemical Society, Annual Meeting, Miami, Fla., September 12, 1978. "In Vitro Studies on the Metabolic Oxidations of Aliphatic Amines to Chemically Reactive Species."

Invited Lecturer, Department of Pediatrics/Pharmacology, Univeristy of Arizona, Tucson, Az., January 21, 1980.

"Metabolism of Tertiary Amines."

Invited Lecturer, National Health Agency, Cairo, Egypt, October 13-17, 1980. "Combined Applicatin of Sectroscopic Techniques to Structural Elucidation."

Invited Lecturer, Department of Organic Pharmceutical Chemistry, Biomedical Center, University of Uppsala, Uppsala, Sweden, December 8-13, 1980. "Iminium Ions in Drug Metabolism."

Invited Lecturer, Rockefeller University, Bellagio, Italy, February 16-20, 1981. "Design of Antiparasitic Drugs."

Invited Lecturer, Mass Spectrometry Discussion Group of the Greater Washington Area, Johns Hopkins University, School of Medicine, Baltimore, Md., February 23, 1981. "Metabolic Studeis of Tertiary Amines."

Invited Lecturer, St. Louis Section, American Chemical Society, St. Louis university, St. Louis, Mo., April 24, 1981. "Metabolic Formation of Imminium Ions."

Invited Lecturer, FDA Pharmacists, Rockville, Md., April 28, 1981. "Experiences of a Special Assistant to the Commissioner."

Invited Lecturer, Department of Pharmacy and Allied Health Professions, Section of Medicinal Chemistry, Northeastern University, Boston, Ma., April 30, 1981. "Metabolic Studies on Tertiray Amines."

Invited Lecturer, Department of Toxicology and Food Nutrition, Massachusetts Institute of Technology, Cambridge, Ma., May 1, 1981. "Amine Metabolism."

Invited Lecturer, Genetic and Environmental Toxicology Association of Northern California, Berkeley, Ca., October 30, 1981. "Principals of Drug Metabolism."

SERVICE TO EDITORIAL BOARDS OF JOURNALS.

Member Editorial Board, Communications in Psychopharmacology, 1976-.

Reviewer, Journal of the American Chemical Society, 1970-.

Reviewer, Journal of Organic Chemistry, 1970-.

Reviewer, Journal of Medicinal Chemistry, 1970-.

Reviewer, Journal of Analytical Chemistry, 1970-.

2021575001

Reviewer, Journal of Pharmaceutical Chemistry, 1970-.

Reviewer, Science, 1970-.

Reviewer, Journal of Chromatography.

Exhibit 4

SUBJECT 20 COTININE DATA

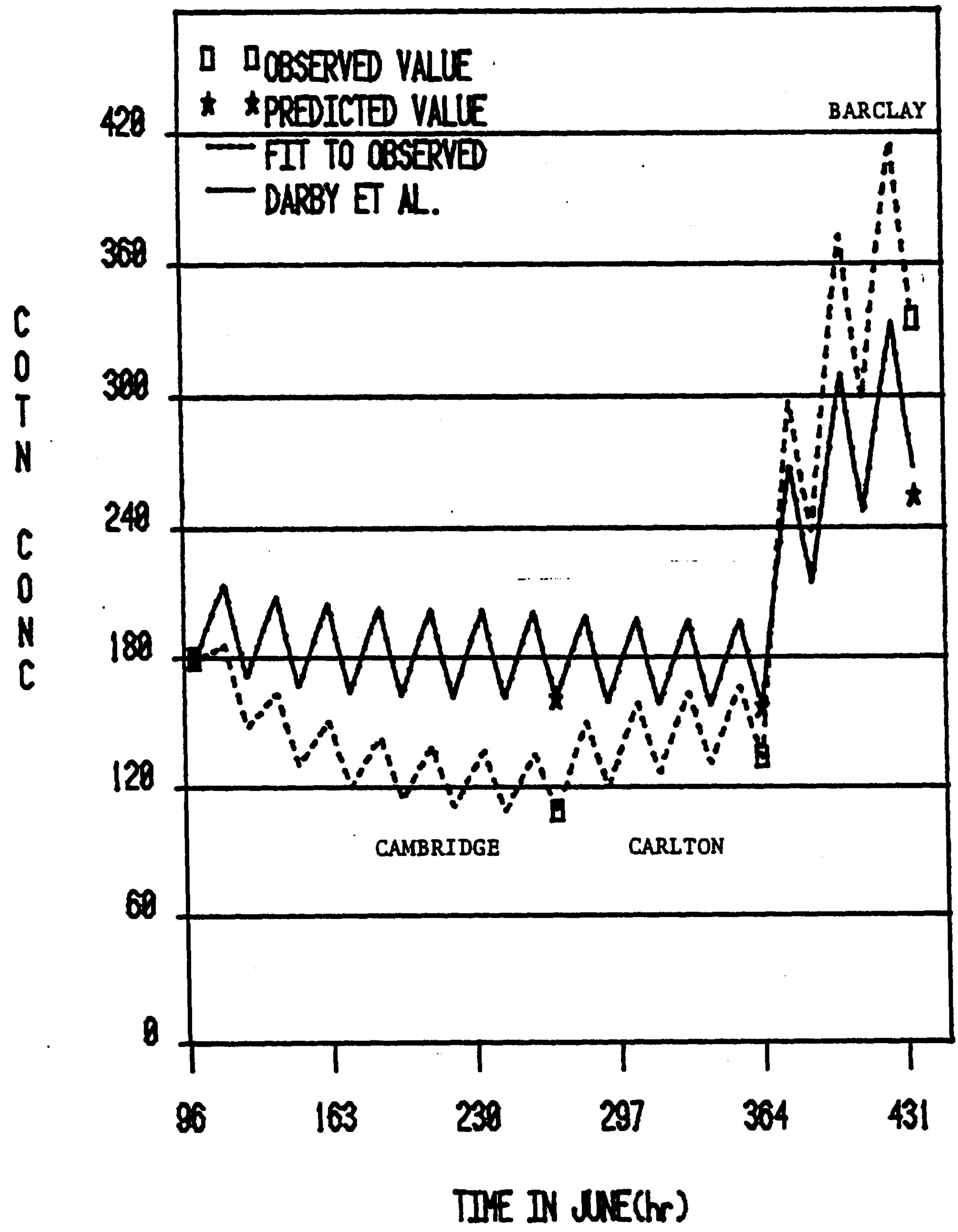

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Exhibit 5

SUBJECT 25 COTININE DATA

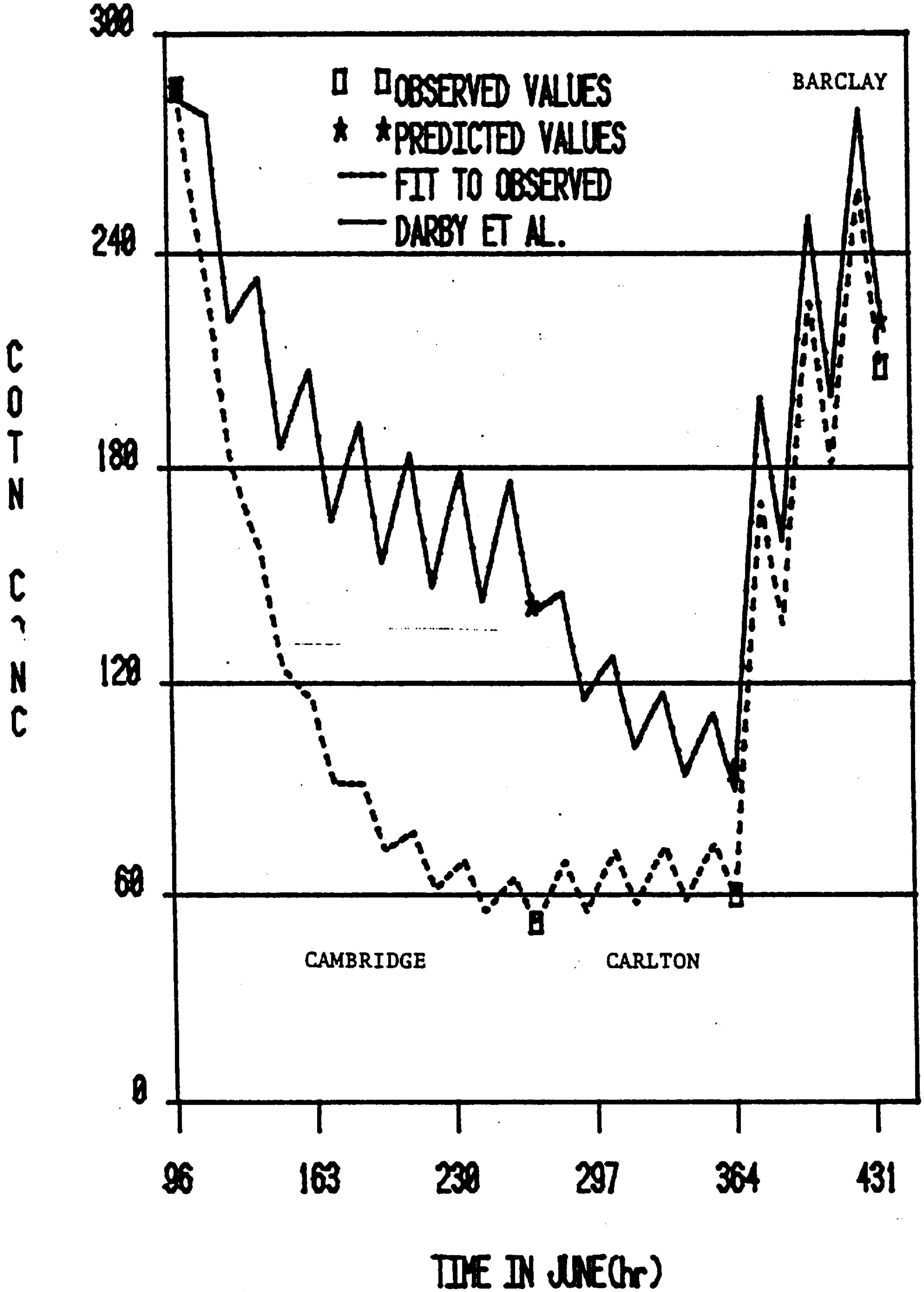

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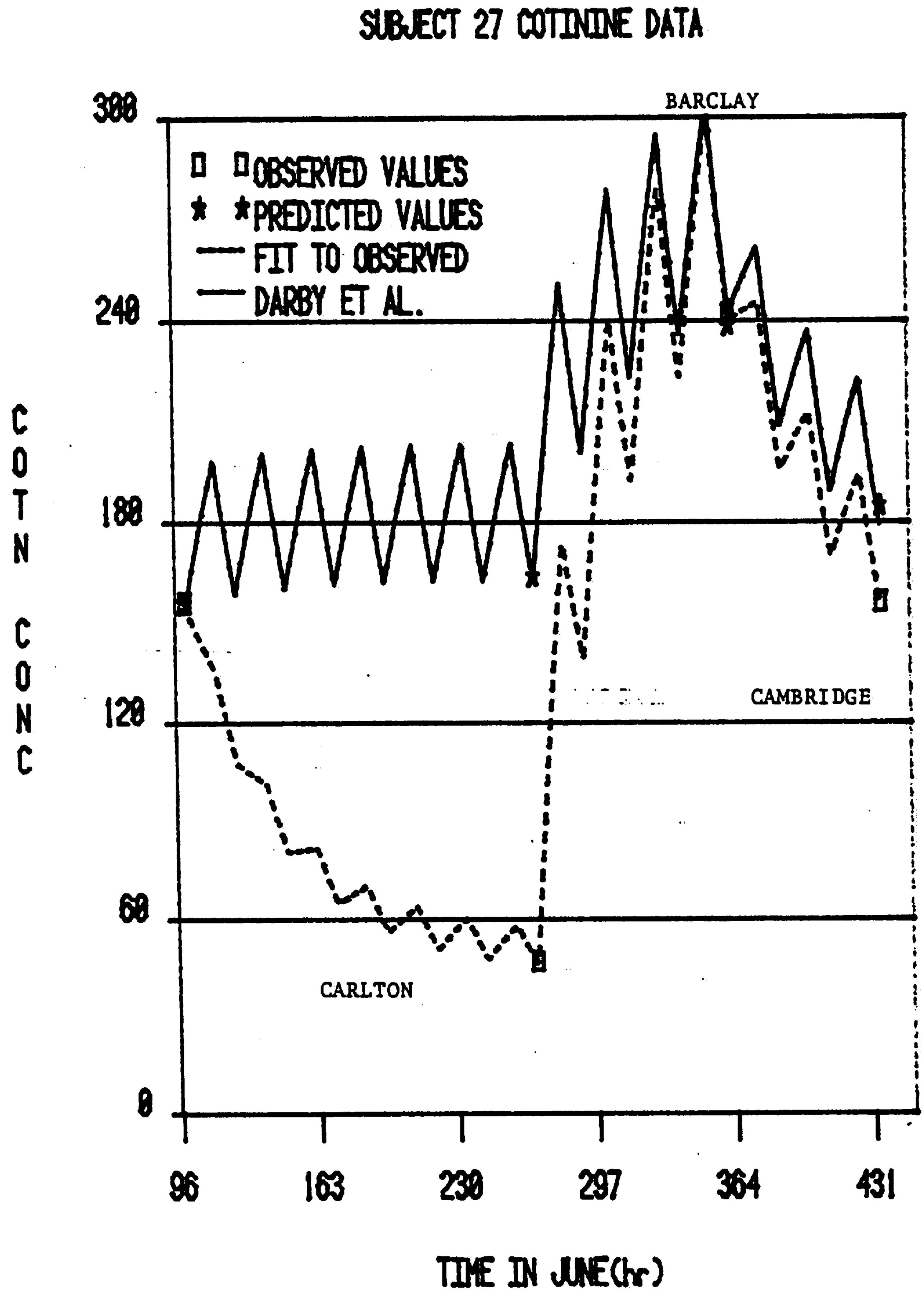
Exhibit 6



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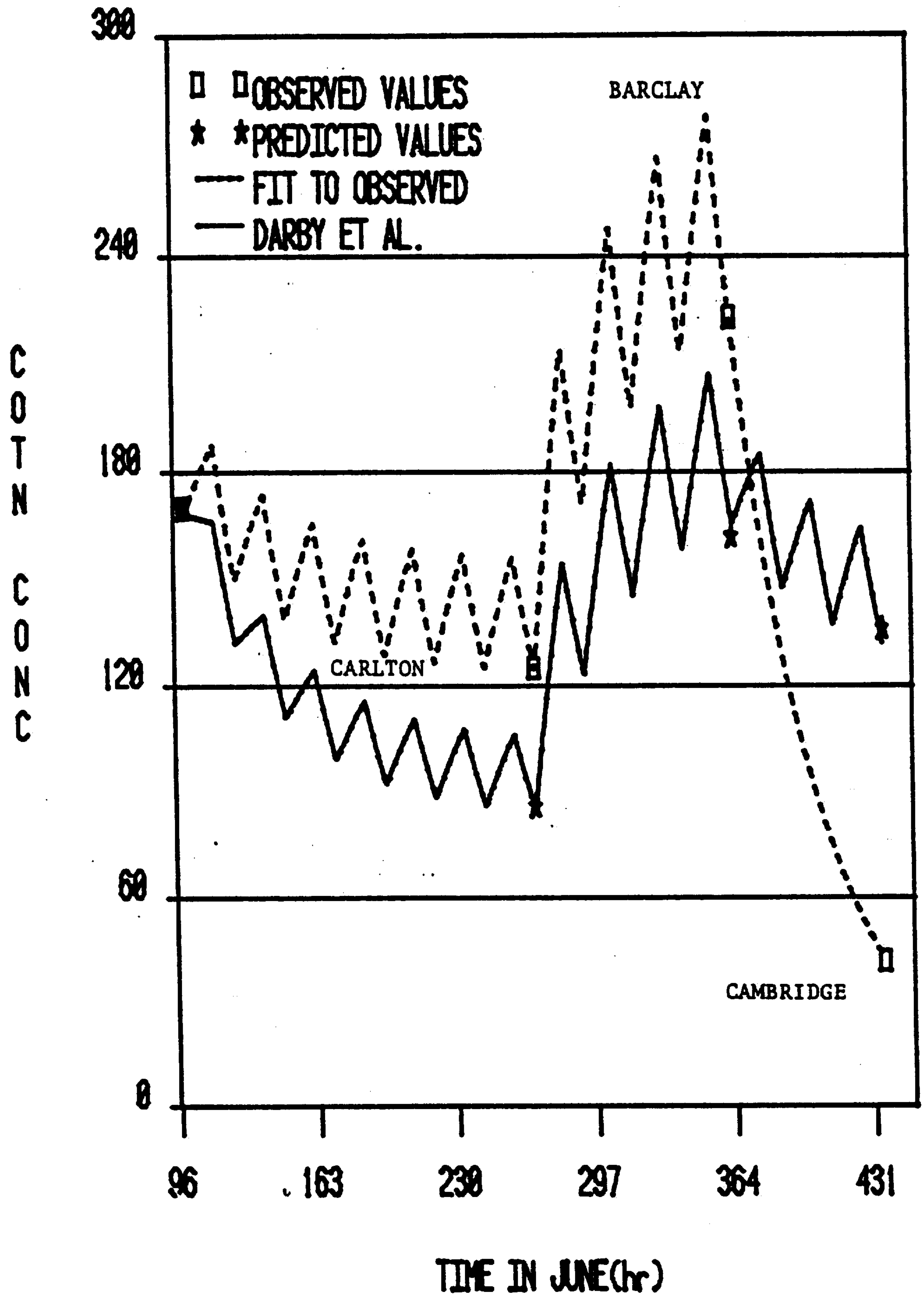
SUBJECT 28 COTININE DATA

Exhibit 7



2021575006

I. BACKGROUND AND PURPOSE

I. BACKGROUND AND PURPOSE

During January of 1982, the Arnold & Porter law firm contacted the United States Testing Company, Inc. for purposes of conducting a research program to measure the in vivo air dilution of ventilated cigaretttes.

The brands selected for testing were:

- Each Respondent's Own Brand
- Barclay
- Carlton
- Merit
- Extended Filter

The brands of cigarettes selected for testing included a medium and a high dilution cigarette. Included were each respondent's own brand of cigarette. The basis for inclusion of own brand of cigarette related to a percent share of market of most leading brands of cigarettes. A final inclusion was an Extended Filter cigarette, which was similar to the Barclay cigarette in construction, however, the filter was longer than the longest Barclay cigarette available on the market.

The respondent panel was comprised of five-hundred (500) regular filtered cigarette smokers. All respondents participated in an unlit test. One-hundred thirty-four (134) of the five hundred (500) respondents participated in a lit test.

A separate cell of forty-seven (47) regular Barclay smokers was included in the test.

2021575008

UNITED STATES TESTING COMPANY, INC.

II. SUMMARY OF RESULTS

2021575009

II. SUMMARY OF RESULTS

The results of this research program are summarized as follows:

TABLE I

TOTAL % DILUTION

	UNLIT		LIT	
	Average % Dilution Tipped	Average % Dilution Untipped	Average % Dilution Tipped	Average % Dilution Untipped
Respondent's Own Brand	24.5	24.5	37.7	37.0
Barclay	73.1	45.6	79.9	55.6
Carlton	69.1	69.5	76.3	75.7
Merit	32.4	33.2	42.7	42.9
Extended Filter	72.2	32.2	80.0	42.0

% DILUTION

BARCLAY PANEL

	UNLIT		LIT	
	Average % Dilution Tipped	Average % Dilution Untipped	Average % Dilution Tipped	Average % Dilution Untipped
Own Brand Barclay	73.4	43.1	79.8	54.6
Barclay (Test)	76.8	49.9	82.8	60.2
Carlton	71.1	70.2	80.7	79.4
Merit	31.4	31.3	41.7	41.0
Extended Filter	71.9	33.4	80.5	45.4

2021575010

UNITED STATES TESTING COMPANY, INC.

TABLE II

% DILUTION BY BRAND TYPE

UNLIT

	Base Number of Respondents	Average % Dilution Tipped	Average % Dilution Untipped
Own Brand (Total)	(500)	(24.5)	(24.5)
King	241	24.0	23.4
100	122	27.6	28.1
King Menthol	106	19.5	19.7
100 Menthol	31	33.1	34.4
Test Barclay (Total)	(500)	(73.1)	(45.6)
King	241	76.8	47.5
100	122	68.0	42.9
King Menthol	106	73.0	46.3
100 Menthol	31	64.4	38.9
Carlton (Total)	(500)	(69.1)	(69.5)
King	241	72.8	72.6
100	122	58.5	60.0
King Menthol	106	75.3	75.5
100 Menthol	31	60.8	62.1
Merit (Total)	(500)	(32.4)	(33.2)
King	241	32.9	33.6
100	122	30.8	31.4
King Menthol	106	33.2	33.9
100 Menthol	31	32.8	34.8
Extended Filter (Total)	(500)	(72.2)	(32.2)
King	241	71.7	32.0
100	122	73.3	31.5
King Menthol	106	72.7	34.6
100 Menthol	31	70.4	27.1

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UNITED STATES TESTING COMPANY, INC.

TABLE II (CONT'D.)

% DILUTION BY BRAND TYPE

LIT

	Base Number of Respondents	Average % Dilution Tipped	Average % Dilution Untipped
Own Brand (Total)	(134)	(24.5)	(24.5)
King	70	24.0	23.4
100	43	27.6	28.1
King Menthol	15	19.5	19.7
100 Menthol	6	48.1	49.6
Test Barclay (Total)	(134)	(73.1)	(45.6)
King	70	76.8	47.5
100	43	68.0	42.9
King Menthol	15	73.0	46.3
100 Menthol	6	73.6	50.5
Carlton (Total)	(134)	(69.1)	(69.5)
King	70	72.8	72.6
100	43	58.5	60.0
King Menthol	15	75.3	75.5
100 Menthol	6	73.0	68.8
Merit (Total)	(134)	(32.4)	(33.2)
King	70	32.9	33.6
100	43	30.8	31.4
King Menthol	15	33.2	33.9
100 Menthol	6	36.7	39.2
Extended Filter (Total)	(134)	(72.2)	(32.2)
King	70	71.7	32.0
100	43	73.3	31.5
King Menthol	15	72.7	34.5
100 Menthol	6	81.8	42.5

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UNITED STATES TESTING COMPANY, INC.

TABLE II (CONT'D.)

% DILUTION BY BRAND TYPE

BARCLAY PANEL

UNLIT

	Base Number of Respondents	Average % Dilution Tipped	Average % Dilution Untipped
Own Brand Barclay	(47)	(73.4)	(43.1)
King	35	75.3	42.2
100	6	63.0	38.4
King Menthol	5	73.1	54.5
100 Menthol	1	69.0	44.7
Test Barclay (Total)	(47)	(76.8)	(49.9)
King	35	80.3	50.3
100	6	63.2	42.6
King Menthol	5	71.2	56.2
100 Menthol	1	65.7	47.0
Carlton (Total)	(47)	(71.1)	(70.2)
King	35	72.9	72.4
100	6	58.1	56.6
King Menthol	5	77.7	76.4
100 Menthol	1	55.3	47.7
Merit (Total)	(47)	(31.4)	(31.3)
King	35	31.2	31.1
100	6	29.7	29.8
King Menthol	5	34.5	34.5
100 Menthol	1	33.7	30.3
Extended Filter (Total)	(47)	(71.9)	(33.4)
King	35	72.2	32.6
100	6	71.0	35.9
King Menthol	5	72.5	38.3
100 Menthol	1	67.3	21.0

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UNITED STATES TESTING COMPANY, INC.

TABLE II (CONT'D.)

% DILUTION BY BRAND TYPE

BARCLAY PANEL

LIT

	Base Number of Respondents	Average % Dilution Tipped	Average % Dilution Untipped
Own Brand Barclay	(47)	(79.8)	(54.6)
King	35	81.3	53.8
100	6	71.7	52.7
King Menthol	5	81.3	67.3
100 Menthol	1	69.5	30.0
Test Barclay (Total)	(47)	(82.8)	(60.2)
King	35	86.0	63.3
100	6	70.5	50.5
King Menthol	5	76.9	54.9
100 Menthol	1	76.0	36.0
Carlton (Total)	(47)	(80.7)	(79.4)
King	35	83.0	81.4
100	6	66.2	65.7
King Menthol	5	85.9	85.4
100 Menthol	1	62.0	59.5
Merit (Total)	(47)	(41.7)	(41.0)
King	35	41.6	40.9
100	6	41.5	40.9
King Menthol	5	42.6	44.8
100 Menthol	1	39.5	26.5
Extended Filter (Total)	(47)	(80.5)	(45.4)
King	35	80.9	43.9
100	6	79.2	51.9
King Menthol	5	79.4	50.8
100 Menthol	1	81.5	34.0

2021575014

III. SUMMARY OF RESEARCH DESIGN

UNITED STATES TESTING COMPANY, INC.

III. SUMMARY OF RESEARCH DESIGN

A. RESPONDENT PANEL

Five-hundred (500) respondents were pre-recruited for study participation via telephone, group and direct intercept recruiting. Respondents qualified for study participation if they:

- Had no critical industry affiliation,
- Had not participated in any market research survey three months prior to the test date,
- Had not participated in any market research survey concerning cigarettes in the past year, and
- Smoked at least ten (10) filtered cigarettes daily.

Utilizing the brand share, age and sex quotas derived from the 1981 Roper Reports the following quotas were established.

- 51.2% of the panel male
  - 44.7% 18-34 years of age
  - 55.3% 35 and older

- 48.8% of the panel female
  - 43.7% 18-34 years of age
  - 56.3% 35 and older

2021575016

UNITED STATES TESTING COMPANY, INC.

All of the respondents participated in an unlit test and one-hundred thirty-four (134) of the five-hundred (500) participated in a lit test.

Due to a twenty percent (20%) over recruitment required to accommodate no shows, etc., the following represents the final quotas achieved.

	UNLIT	LIT
• Male	47.0	47.7
18-34 years of age	67.0	52.0
35 and older	33.0	48.0
• Female	53.0	52.2
18-34 years of age	48.0	33.0
35 and older	52.0	67.0

Respondents were further screened for regular brand of cigarette smoked to include the following brand share representation. The final test brand quotas vary slightly from the target quota.

BRAND	TARGET PERCENT	UNLIT TEST FINAL PERCENT	LIT TEST FINAL PERCENT
Barclay	1.4	1.6	3.7
Belair	1.2	0.8	NONE
Benson & Hedges	4.6	4.8	4.5
Camel Lights	2.6	0.4	NONE
Carlton	2.4	1.4	2.2
Doral	0.4	NONE	NONE
Golden Lights	1.6	0.6	NONE
Kent	3.0	4.0	6.7

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BRAND	TARGET PERCENT	UNLIT TEST FINAL PERCENT	LIT TEST FINAL PERCENT
Kool	8.2	6.0	8.8
L & M	0.8	3.0	2.6
Lark	0.4	0.7	0.2
Marlboro	18.4	24.6	26.8
More	1.6	1.5	0.6
Merit	4.6	3.7	3.6
Newport	2.4	1.5	4.6
Now	0.8	1.0	0.2
Old Gold	0.4	NONE	NONE
Pall Mall	1.2	3.0	2.8
Parliament	1.2	10.4	7.2
Raleigh	1.6	0.7	0.8
Salem	8.8	4.5	8.4
Saratoga	0.4	NONE	0.2
Tareyton	1.6	0.7	0.8
Triumph	0.4	NONE	NONE
True	1.6	6.0	4.6
Vantage	3.8	4.5	2.2
Viceroy	1.6	1.0	o.8
Virginia Slims	2.6	2.2	3.0
Winston	12.2	7.5	7.4
All Other Brands	7.2	1.0	0.8

2021575018

It was further ascertained during screening whether the respondent's own brand was a:

- Regular (King)
- 100's
- Regular (King) Menthol
- 100's Menthol
- Slim/120's or longer
- Slim/120's or longer Menthol

Once respondents had been successfully screened and were willing to participate they were brought into the test facility. They were requested to bring their own cigarettes with them. One reason was to verify their regular brand, the other reason was as part of their test they would puff their own brand.

Each respondent tested:

- Their Own Brand
- A Barclay
- A Carlton
- A Merit, and
- An Extended Filter

Furthermore, with the exclusion of the Extended Filter, each respondent received a Barclay, a Carlton and a Merit compatible to their own brand: either regular flavor King or 100's or mentholated King or 100's. Those few respondents who normally smoked a slim, 120 or longer received 100's of the aforementioned brands.

Testing for all respondents was initially conducted with unlit cigarettes. Respondents adhered to the following progression of testing:

- First they puffed on their own brand of cigarette three times to familiarize themselves with the basic test procedure. That cigarette was discarded.
- A second own brand cigarette was then attached to the Puff Parameter Analyzer with a tip applied to the cigarette. The respondent puffed three times to confirm the test unit's proper functioning.
- Using the same tipped own brand cigarette the respondent then puffed three more times. The percent dilution for each puff was recorded.
- The tip was removed and the percent dilution of three more puffs was recorded.

- The respondent always puffed their own brand first, tipped then untipped. They then puffed a Barclay, a Carlton, a Merit and an Extended Filter three times tipped, followed by three times untipped. The percent dilution was recorded after each individual puff. The presentation of these brands was rotated among the respondent panel.

- Those respondents who participated in the lit test adhered to the aforementioned procedures, with the exception of taking two (2) puffs, rather than three (3) for each brand. Additionally, all puffs recorded after verifying unit functioning, was with lit cigarettes.

The aforementioned procedures employed for the unlit test and lit test were followed for the separate panel of regular Barclay smokers.

While the individual cigarettes were not brand blinded, the cigarettes were presented in a covered tray and during the puff test the respondent could not see the brand identification. The brands of cigarettes tested and the purpose of the study was not disclosed at any time to any respondent, during screening, during the test conduct or after.

Three (3) Puff Parameter Analyzers were used throughout the study. The use of each machine was rotated across the respondent panel. The respondents were so positioned that during the test they could not see the front of the test units.

2021575021

Testing occurred at the United States Testing Company's Hoboken facility, Monday, January 25 through Saturday, February 6, 1982.

All test product, excluding the Extended Filter, was purchased at the wholesale level from two different wholesalers, by a representative the Testing Company from the Northeastern section of New Jersey, specifically Hoboken and North Bergen. All product purchased was in soft packs only.

A copy of the test materials is included in the Appendix of this report.

The following details the test procedures utilized.

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IV. DETAILED RESEARCH DESIGN

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UNITED STATES TESTING COMPANY, INC.

TEST PROCEDURAL FLOW

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UNITED STATES TESTING COMPANY, INC.

TEST PROCEDURES

UNLIT TEST

GENERAL INFORMATION

1. Test Familiarization Puff: Each respondent should be asked to puff three times on one of their own cigarettes with no tip and not attached to apparatus. This is so they can familiarize themselves with puffing on an unlit cigarette.
2. Verification: Each time a new respondent enters, you must perform a dilution test to verify the machine is operating properly. For this part of the test, the respondent's own cigarette is always the cigarette used. The cigarette is always tipped. The respondent will be required to puff on this cigarette three times to fulfill test requirements.

ALWAYS RESET MACHINE AFTER DILUTION TEST

3. Actual Test: In the actual puff test, each cigarette will be puffed three times with a tip and three times without a tip.
4. The respondent's own cigarette is always the first cigarette tested. The code number for respondent's own cigarette is always #81.
5. Each cigarette is always tested FIRST WITH TIP and SECOND WITHOUT TIP.
6. Although you offer water at the beginning of the test, ask the respondent once or twice during the test if they would like a sip.
7. If you notice Puff Volume decreasing from puff to puff, the respondent may be becoming fatigued. If this occurs ask if they would like to rest a moment. (DO NOT INDICATE WHY YOU ARE ASKING.) Abide by their response.

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8. If a puff is invalid, DO NOT tell respondent something is wrong, puff was invalid, or any other phrase which might intimidate them. Simply X out data on print-out and ask respondent to puff again.

BE SURE YOU ALWAYS HAVE 3 VALID PUFFS WITH TIP AND 3 VALID PUFFS WITHOUT TIP.

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UNITED STATES TESTING COMPANY, INC.

TEST PROCEDURE

UNLIT TEST

RESPONDENT ENTERS.

Hello, Mr./Ms.__________. Today we are conducting a test about smoking. I would like to let you know that during this test if you wish to stop for a moment to rest, it is fine. Also should your mouth become dry, we have a cup of water here for you to drink. Please feel free to take a sip whenever you wish.

I will be asking you to puff on five different cigarettes. None of them will be lit. One of them will be your own brand. I will need two of your cigarettes from your pack. HAND RESPONDENT ONE OF THEIR OWN UNLIT CIGARETTES. So you can familiarize yourself with the procedure, I would like you to puff three times on this cigarette of yours as if it were lit. THEN PLACE THE OTHER ONE OF RESPONDENT'S CIGARETTES IN #1 SLOT IN CIGARETTE TRAY. BEGIN TEST.

DILUTION TEST

WHILE RESPONDENT IS DOING THIS YOU MUST DO THE FOLLOWING:

1. INSERT THEIR OWN BRAND CIGARETTE (CIG. #1 IN TRAY) - ROD FIRST - INTO HOLDER.

MAKE SURE DENTAL DAMS HAVE SEALED, INSURING NO AIR WILL ENTER HOLDER.

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II. PLACE CIGARETTE IN HOLDER SO THAT DILUTION HOLES ARE INSIDE HOLDER.

DILUTION HOLES MUST BE TOTALLY INSIDE GLASSWARE.

HOLDING ROD STEADY SO CIGARETTE DOESN'T MOVE, PLACE TIP ON EXPOSED FILTER PART OF CIGARETTE. MOVE TO MARKED LINE (EVEN WITH DENTAL DAM ON HOLDER).

CHECK TO MAKE SURE DENTAL DAM IS PROPERLY SEALED SO THAT NO AIR WILL ENTER THE TIP.

III. PLACE COMPLETED HOLDER INTO STRAIGHT CHAMBER AND TIGHTEN SCREW CAP SO THAT HOLDER CANNOT BE PULLED FROM CHAMBER.

IV. CHECK TO MAKE SURE THAT BLACK CODED TUBING FOR DILUTION TEST IS CORRECTLY ATTACHED - ONE END ON ROD PORT IN BACK, THE OTHER ON THE DILUTION PORT IN FRONT. TUBING FOR ACTUAL PUFF TEST IS ATTACHED AS FOLLOWS:

TUBE COLOR CODED RED (LEADING TO STRAIGHT CHAMBER) IS ATTACHED TO ROD PORT - COLOR CODED RED-ON FRONT OF MACHINE. TUBE COLOR CODED BLUE (ATTACHED TO HOLDER) IS NOT ATTACHED TO MACHINE. <u>BLUE CODED END IS PLUGGED CLOSED DURING DILUTION TEST.</u> <u>THIS TUBE IS NOT ATTACHED TO MACHINE DURING DILUTION TEST.</u>

FEED PRINTER PAPER AND WRITE RESPONDENT NUMBER AND "TRIAL" ON END OF TAPE. AFTER DOING AND CHECKING ABOVE, TAKE RESPONDENT'S PRACTICE CIGARETTE AND THROW IT AWAY. HAND RESPONDENT ASSEMBLED APPARATUS.

2021575028

Now, I would like you to puff on this cigarette as if it were lit. You may adjust the tip to fit comfortably into your mouth. I will let you know when it is OK to puff and you may respond at your leisure.

FLIP RUN/LOCK SWITCH FROM LOCK TO RUN.

Whenever you're ready, please puff.

WHEN RESPONDENT HAS COMPLETED PUFF AND STATUS READS WAIT RETURN RUN/LOCK SWITCH TO LOCK.

CHECK NUMBERS 4, 5, 6 ON MACHINE. MAKE SURE PERCENT DILUTION READS 50 +/- 2, i.e., 48 or 52. (IF IT DOESN'T CALL TEST SUPERVISOR TO CHECK.) WHEN YOU ARE SURE THAT YOU HAVE A VALID PUFF FLIP RUN/LOCK SWITCH BACK TO RUN. MAKE SURE STATUS READS READY. (THIS 50 +/- 2 REFERS TO VERIFYING PUFFS <u>ONLY</u>.)

REPEAT FOR VERIFY PUFF #2.

REPEAT FOR VERIFY PUFF #3.

WHEN YOU ARE SURE YOU HAVE A VALID THIRD PUFF, TAKE THE FOLLOWING STEPS FOR:

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UNITED STATES TESTING COMPANY, INC.

ACTUAL PUFF TEST

I. TAKE APPARATUS FROM RESPONDENT.

II. REMOVE BLACK CODED TUBING FROM DILUTION PORT.

III. UNPLUS BLUE CODED TUBING AND ATTACH TO DILUTION PORT ALSO CODED BLUE.

IV. PUSH RESET BUTTON ON BACK OF MACHINE. AT THIS POINT PRINTER WILL ONCE AGAIN PRINT OUT FORMAT.

V. WHEN PRINTER HAS STOPPED, DRAW A LINE ACROSS THE PAPER. IN LEFT MARGIN ABOVE LINE WRITE CODE NUMBER OF CIGARETTE AND A "T" TO INDICATE THE PUFF IS BEING TAKEN WITH A TIP.

VI. HAND APPARATUS BACK TO RESPONDENT.

VII. FLIP RUN/LOCK SWITCH TO RUN.

I'm going to ask you to take three puffs one at a time, on this cigarette as if it were lit. Whenever you are ready.

AFTER RESPONDENT HAS COMPLETED PUFF AND STATUS READS WAIT, RETURN RUN/LOCK SWITCH TO LOCK. CHECK READINGS ON #4, 5 AND 6. WHEN YOU ARE SURE YOU HAVE A VALID READING, FLIP RUN/LOCK SWITCH TO RUN.

REPEAT FOR TEST PUFF #2 - TIPPED.

REPEAT FOR TEST PUFF #3 - TIPPED.

AFTER YOU ARE SURE YOU HAVE THREE VALID PUFFS WITH TIP, ASK RESPONDENT FOR APPARATUS. AT THIS TIME, REMOVE THE TIP FROM THE CIGARETTE. RECONFIRM CIGARETTE IS STILL IN PLACE WITH MARK FLUSH WITH DENTAL DAM ON HOLDER.

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FEED PAPER TO INDICATE END OF TIPPED PART OF TEST. WRITE "UT" IN LEFT HAND MARGIN TO INDICATE UNTIPPED PART OF TEST. HAND APPARATUS TO RESPONDENT.

FOR THIS PORTION OF TEST IN WHICH CIGARETTE IS UNTIPPED, REPEAT ALL STEPS FOR TIPPED PORTION OF TEST.

AFTER YOU ARE SURE YOU HAVE THREE VALID PUFFS WITHOUT TIP ASK RESPONDENT TO RETURN APPARATUS TO YOU.

I. REMOVE HOLDER FROM STRAIGHT CHAMBER.

II. REMOVE CIGARETTE FROM HOLDER BY PULLING ROD.

III. PLACE CIGARETTE IN VIAL MARKED WITH RESPONDENT NUMBER.

IV. FEED PRINTER PAPER AND DRAW LINE ACROSS IT TO INDICATE END OF TEST FOR THAT CIGARETTE.

ABOVE LINE IN LEFT MARGIN WRITE CODE NUMBER FOR CIGARETTE #2 AND A "T" TO INDICATE TIPPED.

V. TAKE CIGARETTE #2 FROM CIGARETTE TRAY - TOUCHING ROD ONLY - AND FOLLOW HOLDER INSERTION AND TIPPING PROCEDURE FOR CIGARETTE #1. FOLLOW OPERATIONS PROCEDURES LISTED ABOVE FOR CIGARETTES #2 THROUGH #5. AFTER LAST PUFF ON CIGARETTE #5 SAY:

Thank you very much for your time and cooperation.

FEED PRINTER PAPER, CUT OFF AND PUT INTO RESPONDENT'S FOLDER.

CAP VIAL WITH ALL FIVE CIGARETTES TESTED IN IT AND PUT ONTO TRAY.

REMOVE HOLDER AND PLACE ON TRAY SO THAT TRAY PREP PERSON MAY CHANGE DENTAL DAMS. RETURN TRAY TO TRAY PREPARATION PERSON, OBTAIN TRAY FOR NEXT RESPONDENT AND FOLLOW ABOVE PROCEDURES.

UNITED STATES TESTING COMPANY, INC.

TEST PROCEDURES

LIT TEST

GENERAL INFORMATION

BECAUSE TIMING IS CRUCIAL IN THIS TEST THREE PEOPLE WILL BE AT THE MACHINE FUNCTIONING AS FOLLOWS:

MACHINE OPERATOR: Reading data, operating RUN/LOCK SWITCH, writing, helping handle glassware.

ASSISTANT: Doing the bulk of work with glassware, cigarettes, code numbers, etc.

PUMP OPERATOR: Operates pump to clear out smoke chamber between puffs.

1. Test Familiarization Puff: Each respondent should be asked to puff two times on one of their own cigarettes with no tip and not attached to apparatus. This is so they can familiarize themselves with puffing on an unlit cigarette for verification test.
2. Verification: Each time respondent enters, you must perform a dilution test to verify the machine is operating properly. The cigarette is UNLIT for this part of test. For this part of the test, the respondent's own cigarette is always the cigarette used. The cigarette is always tipped. The respondent will be required to puff on this cigarette two times to fulfill test requirements.

ALWAYS RESET MACHINE AFTER DILUTION TEST

UNITED STATES TESTING COMPANY, INC.

3. Actual Test: After the cigarette is lit, each cigarette will be puffed two times with a tip and two times without a tip.
4. The respondent's own cigarette is always the first cigarette tested. The code number for respondent's own cigarette is always #81.
5. The cigarette is always tested FIRST WITH TIP and SECOND WITHOUT TIP. Timing is of the essence. If a total of four puffs are not obtained before cigarette reaches dental dam, entire procedure (except trial) must be repeated with a new cigarette. All four puffs MUST come from one cigarette.
6. Although you offer water at the beginning of the test, ask the respondent once or twice during the test if they would like a sip.
7. If you notice Puff Volume decreasing from puff to puff, the respondent may be becoming fatigued. If this occurs ask if they would like to rest a moment. (DO NOT INDICATE WHY YOU ARE ASKING.) Abide by their response. Ask only between cigarettes.
8. If a puff is invalid, DO NOT tell respondent something is wrong, that the puff was invalid, or any other phrase which might intimidate them. Simply X out information on printed paper.

ALWAYS MAKE SURE YOU HAVE 2 VALID PUFFS WITH TIP AND 2 VALID PUFFS WITHOUT TIP.

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UNITED STATES TESTING COMPANY, INC.

TEST PROCEDURES

LIT TEST

Hello, Mr./Ms.______. Today we are conducting a test about smoking. I would like to let you know that during this test if you wish to stop for a moment to rest, it is fine. Also, should your mouth become dry, we have a cup of water here for you to drink. Please feel free to take a sip whenever you wish.

There are two parts to this test. First, I will be asking you to puff on five different cigarettes. None of them will be lit. One of them will be your own brand. Next, I will ask you to puff on five different cigarettes lit. One of them will be your own brand. I will need three of your own cigarettes.

(PLACE ONE OF RESPONDENT'S CIGARETTES IN NUMBER ONE SLOT IN CIGARETTE TRAY.)

(AT THIS POINT - PERFORM ALL STEPS FOR UNLIT TEST INCLUDING "TRIAL.)

AFTER UNLIT TEST IS COMPLETE, PUT PRINT OUT IN RESPONDENT FILE AND PUT FILE AND TRAY ASIDE, PERFORM FOLLOWING STEPS FOR LIT TEST.

DILUTION TEST

I. ATTACH BLACK CODED TUBING TO MACHINE.

II. INSERT THEIR OWN BRAND CIGARETTE - ROD FIRST - INTO HOLDER.

MAKE SURE DENTAL DAMS HAVE SEALED, INSURING NO AIR WILL ENTER HOLDER.

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III. PLACE CIGARETTE IN HOLDER SO THAT DILUTION HOLES ARE INSIDE HOLDER.

DILUTION HOLES MUST BE TOTALLY INSIDE GLASSWARE.

HOLDING ROD STEADY SO CIGARETTE DOESN'T MOVE, PLACE TIP ON EXPOSED FILTER PART OF CIGARETTE. MOVE IT SO IT IS FLUSH WITH DENTAL DAM ON HOLDER.

CHECK TO MAKE SURE DENTAL DAM IS PROPERLY SEALED SO THAT NO AIR WILL ENTER THE TIP.

IV. PLACE COMPLETED HOLDER INTO SMOKING CHAMBER AND TIGHTEN SCREW CAP SO THAT HOLDER CANNOT BE PULLED FROM CHAMBER.

V. CHECK TO MAKE SURE THAT BLACK CODED TUBING FOR DILUTION TEST IS CORRECTLY ATTACHED - ONE END ON ROD PORT IN BACK, THE OTHER ON THE DILUTION PORT IN FRONT. TUBING FOR ACTUAL PUFF TEST IS AS FOLLOWS:

TUBE COLOR CODED RED (LEADING TO SMOKING CHAMBER) IS ATTACHED TO ROD PORT - COLOR CODED RED ON FRONT OF MACHINE. TUBE COLOR CODED DARK BLUE (ATTACHED TO HOLDER) IS NOT ATTACHED TO MACHINE. DARK BLUE CODED END IS PLUGGED CLOSED DURING DILUTION TEST. THIS TUBE IS NOT ATTACHED TO MACHINE DURING DILUTION TEST.

FEED PRINTER PAPER AND WRITE RESPONDENT NUMBER ON END OF TAPE. AFTER DOING AND CHECKING ABOVE, TAKE RESPONDENT'S CIGARETTE AND THROW IT AWAY. HAND RESPONDENT ASSEMBLED APPARATUS.

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Now, I would like you to puff on this cigarette as if it were lit. You may adjust the tip to fit comfortably into your mouth. I will let you know when it is OK to puff and you may respond at your leisure.

FLIP RUN/LOCK SWITCH FROM LOCK SWITCH FROM LOCK TO RUN.

Whenever you're ready, please puff.

WHEN RESPONDENT HAS COMPLETED PUFF AND STATUS READS WAIT RETURN RUN/LOCK SWITCH TO LOCK.

CHECK NUMBERS 4, 5, 6 IN LEFT MARGIN OF TAPE COMING FROM PRINTER. WRITE "TRIAL".

MAKE SURE PERCENT DILUTION READS 50 +/-2, i.e., 48 or 52. (IF IT DOESN'T, CALL TEST SUPERVISOR TO CHECK.) WHEN YOU ARE SURE THAT YOU HAVE A VALID PUFF FLIP RUN/LOCK SWITCH BACK TO RUN. MAKE SURE STATUS READS READY. (THIS 50+/-2 REFERS TO VERIFYING PUFFS ONLY.)

REPEAT FOR VERIFY PUFF #2.

WHEN YOU ARE SURE YOU HAVE A VALID SECOND PUFF, TAKE THE FOLLOWING STEPS FOR:

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UNITED STATES TESTING COMPANY, INC.

ACTUAL PUFF TEST

I. TAKE APPARATUS FROM RESPONDENT.

II. REMOVE BLACK CODED TUBING FROM DILUTION PORT.

III. UNPLUG BLUE CODED TUBING AND ATTACH TO DILUTION PORT ALSO CODED BLUE.

IV. PUSH RESET BUTTON ON BACK OF MACHINE. AT THIS POINT PRINTER WILL ONCE AGAIN PRINT OUT FORMAT.

V. WHEN PRINTER HAS STOPPED, DRAW A LINE ACROSS THE PAPER. WRITE IN LEFT MARGIN ABOVE LINE CODE NUMBER OF CIGARETTE AND A "T" TO INDICATE THE PUFF IS BEING TAKEN WITH A TIP.

VI. REMOVE HOLDER FROM SMOKING CHAMBER. HAND RESPONDENT HOLDER. LIGHT CIGARETTE. MAKE SURE IT IS LIT. IF ONLY PARTLY LIT ASK RESPONDENT TO TAKE ANOTHER PUFF. REPLACE LIT CIGARETTE INTO SMOKING CHAMBER. HAND APPARATUS BACK TO RESPONDENT.

- VII. FLIP RUN/LOCK SWITCH TO RUN.

I'm going to ask you to take two puffs one at a time, on this cigarette. Whenever you are ready.

AFTER RESPONDENT HAS COMPLETED PUFF AND STATUS READS WAIT, RETURN RUN/LOCK SWITCH TO LOCK. REMOVE HOLDER FROM SMOKING CHAMBER (ASSISTANT WILL HELP). HAND CHAMBER TO ASSISTANT. (PUMP OPERATOR WILL CLEAR SMOKE FROM CHAMBER).

DURING THIS YOU SHOULD READ DATA TO INSURE PUFF IS VALID. WHEN CHAMBER IS CLEARED OF SMOKE YOU AND ASSISTANT WILL SECURE HOLDER IN SMOKE CHAMBER. WHEN HOLDER IS RESECURED HAND APPARATUS BACK TO RESPONDENT.

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FLIP RUN/LOCK SWITCH TO RUN.

REPEAT FOR TEST PUFF #2 - TIPPED.

AFTER YOU ARE SURE YOU HAVE TWO VALID PUFFS WITH TIP, REMOVE TIP FROM CIGARETTE. RECONFIRM CIGARETTE IS STILL IN PLACE WITH MARK FLUSH WITH DENTAL DAM ON HOLDER. FEED PAPER AND WRITE "UT" IN LEFT MARGIN. FOR THIS PORTION OF TEST IN WHICH CIGARETTE IS UNTIPPED, REPEAT ALL STEPS LISTED FOR TIPPED PART OF TEST.

REPEAT FOR TEST PUFF #2 - UNTIPPED

AFTER YOU HAVE CHECKED DATA AND ARE CERTAIN YOU HAVE A VALID SECOND PUFF WITHOUT THE TIP, INDICATE SAME TO ASSISTANT. ASSISTANT WILL THEN CUT OFF LIT END OF CIGARETTE INTO BOWL OF WATER. WITH TWEEZERS ASSISTANT WILL REMOVE CIGARETTE - ROD FIRST - FROM HOLDER AND DEPOSIT IT INTO VIAL MARKED WITH RESPONDENT'S NUMBER.

WHILE ASSISTANT IS INSERTING CIGARETTE #2 INTO HOLDER AND PLACING TIP ON IT (NEW PLASTIC TIP WITH EACH CIGARETTE), YOU WILL FEED PRINTER PAPER, DRAW A LINE ACROSS IT, WRITE IN CODE NUMBER OF NEW CIGARETTE AND A "T" TO INDICATE TIPPED TEST.

FOLLOW OPERATIONS PROCEDURES LISTED ABOVE FOR CIGARETTES #2 THROUGH 5. AFTER LAST PUFF ON CIGARETTE #5:

Thank you very much for your time and cooperation.

FEED PRINTER PAPER, CUT OFF AND PUT INTO RESPONDENT'S FILE. CAP VIAL CONTAINING ALL FIVE CIGARETTES TESTED AND PUT ONTO TRAY.

REMOVE TUBES FROM MACHINE AND PLACE ON TRAY SO THAT GLASS WASHER MAY CLEAN. (AN ENTIRE NEW APPARATUS WILL BE ON NEXT TRAY.)

RETURN TRAY TO TRAY PREPARATION PERSON, OBTAIN TRAY FOR NEXT RESPONDENT AND FOLLOW ABOVE PROCEDURES.

YOU ARE PROVIDED WITH EXTRA GLASS HOLDERS AND TIPS FOR THIS TEST. IF AT ANY TIME THE DENTAL DAMS ARE SINGED OR BECOME DIRTY CHANGE HOLDER OR GLASS TIP. (DENTAL DAMS WILL ALREADY BE ON THEM).

YOU ARE PROVIDED WITH FIVE EXTRA PLASTIC TIPS. BE SURE TO CHANGE PLASTIC TIPS AFTER EACH CIGARETTE SO THAT TASTE WILL NOT OVERWHELM RESPONDENTS.

UNITED STATES TESTING COMPANY, INC.

GLOSSARY OF TERMS

2021575041

GLOSSARY OF TERMS

For the purpose of this test you will need to know the following terminology:

DENTAL DAM - White round rubberized piece with hole in middle

DILUTION HOLES - Holes in wrapping paper around filter

GLASS TIP - Funnel shaped glass piece

HOLDER - Larger glass piece through which cigarette is placed

O - RING - Black rubberized rings

O - RING APPLICATOR - White plastic piece kept in O - ring box to aid in application of dental dams and O - rings to glassware

PLASTIC TIP - White "cigar" tip

ROD - The tobacco part of the cigarette

SMOKING CHAMBER - Large glass jar-like piece with black screw cap to be used for every lit test

STRAIGHT CHAMBER - Long glass tube with black screw cap used for unlit only tests

2021575042

UNITED STATES TESTING COMPANY, INC.

TEST SUPERVISOR

CALIBRATION INSTRUCTIONS

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TEST SUPERVISOR

CALIBRATION INSTRUCTIONS

PRELIMINARY STEPS

1. Turn Power ON/OFF switch to ON. Make sure red ON Light is lit and that format prints out.

   IF ABOVE DOES NOT OCCUR, CHECK ALL ELECTRICAL CONNECTIONS.

2. Allow machines to warm up for at least 30 minutes.

   A PERIOD OF ONE HOUR IS THE PREFERRED WARM UP TIME.

3. Turn on flow calibrator and vacuum pump five to ten minutes prior to beginning calibration.

4. Attach tubing to VACUUM FLOW IN port on front of flow calibrator.

5. Attach vacuum pump tube into VACUUM PUMP port in back of flow calibrator.

6. Check to make sure SOURCE/METER knob is turned to SOURCE.

   NOTE: WHEN VACUUM PUMP IS TURNED ON METER ON BACK OF FLOW CALIBRATOR SHOULD REGISTER 15, +/-1 or 2. IF METER DOES NOT REGISTER CORRECTLY, DO NOT TRY TO READJUST. CALL TECHNICAL SUPERVISOR IMMEDIATELY.

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UNITED STATES TESTING COMPANY, INC.

CALIBRATION

1. After machines have warmed up for the prescribed period of time, turn the RUN/CALIBRATE switch to CALIBRATE.

2. At this time, the display should be reading close to zero on both ROD and DIL. If the readings differ greatly from zero, i.e., greater than 0005, the ZERO adjust pot. should be adjusted with jeweler's screwdriver to bring reading closer to zero.

   Note that the accuracy of the instrument is not affected by any difference the display might show from zero. It does not require a reading of exactly zero to be accurate. Further, if the display is reading exactly zero and never moves from this value, the ZERO adjust pot. for each flow must be adjusted to give a reading in the range of 0001-0005. The reason for this is that the unit does not display negative values and as such the calibration might have it far into the negative range of signals. This will greatly affect the instrument's accuracy and should be avoided.

3. After ZERO for both ROD and DIL have been adjusted so that the display reads between 0001 and 0005 for each, the SPAN must be adjusted. Set the FLOW: CC/MIN display on front of flow calibrator to read 1050.

4. Attach tubing on front of flow calibrator to ROD port on front panel of instrument. NOTHING SHOULD RUN TO THE DIL PORT.

   If the display does not read 1050, adjust SPAN adjust pot. until display does read 1050. Remove tubing from ROD port.

   RE-CHECK ZERO TO INSURE DISPLAY STILL READS 0001-0005 SINCE IT IS AFFECTED BY THE SPAN ADJUSTMENT.

5. If ZERO reading for ROD has risen above 0005, it will have to be readjusted and then the SPAN will have to be readjusted. Repeat process until ZERO reads between 0001 and 0005 and SPAN reads 1050.

6. After both ZERO and SPAN are correctly adjusted for ROD, DIL span must be adjusted.

7. Attach tubing on front of flow calibrator to DIL port on front panel of instrument. NOTHING SHOULD RUN TO ROD PORT

8. If the display does not read 1050, adjust SPAN adjust pot. until display does read 1050. Remove tubing from DIL port.

   RE-CHECK ZERO TO INSURE DISPLAY STILL READS 0001-0005 SINCE IT IS AFFECTED BY THE SPAN ADJUSTMENT.

8. If ZERO reading for DIL has risen above 0005, it will have to be readjusted and then the SPAN will have to be readjusted. Repeat process until ZERO reads between 0001 and 0005 and SPAN reads 1050.

AFTER INSTRUMENT IS CALIBRATED, PUSH THE RESET BUTTON ON THE BACK OF THE MACHINE.

9. Turn RUN/CALIBRATE switch to RUN and make sure RUN/LOCK switch is in LOCK. Display should read HOLD and machine is ready at this point for machine operators.

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